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a symposium on

flood control

and management

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The problem

FLOOD control, simply put, refers to the complex of initiatives directed at insulating areas from inundation. Though the main task appears to be aimed at and restricted to containing potential losses and damage to property and person, ideas on and technologies for flood control have always been deeply implicated in processes of state and imperatives of government. Any meaningful assessment of the 'problem', consequently, must centrally confront questions of political economy that have informed and underscored responses to floods the world over.

In India, the area liable to floods since Independence has actually registered an increase. From roughly 19 million hectares in 1953, the flood prone area is now assessed at being anywhere between 34 million hectares[1] on the lower side and 40 million hectares upwards to a high of 60 million hectares.[2] The average area annually affected by floods has similarly been hiked up from 2.29 million hectares in 1953 to about 7.65 million hectares in 1997.[3] Though these figures must be approached with caution, given the highly unreliable and often contradictory data generated by government monitoring agencies, the trend nevertheless is clearly upwards.

Expenditure for flood control allotted in the respective plans has similarly been on the rise from Rs 132.1 million (2739.8) in the 1st plan (1951-1956) to a high of Rs 16916.8 million (24933.5) in the 8th plan (1992-97).[4] Annual flood damage and losses, however, continue unabated. In 1998, 16 flood affected states petitioned the Centre for approximately Rs 1,150 million as compensation for damages allegedly sustained. Not a single rupee, however, was released by the National Calamity Relief Fund.[5] This paradox of rising expenditure on flood control works, simultaneously with an increase in flood damages still awaits a competent and credible official explanation.

1. B.S. Ahuja, Theme Paper on Non-Structural Measures of Flood Control, prepared by the River Management Wing of Central Water Commission, Ministry of Water Resources, Government of India; presented at a workshop held at the Institute for Public Administration, 8 October 1997.

2. Approximating between one-eighth to one-fifth of the total land area. See *Floods, Flood Plains and Environmental Myths*. State of India's Environment (3). A Citizen's Report, Centre for Science and Environment, New Delhi, 1991, pp. 1-8.

3. B.S. Ahuja, op cit.

4. Figures in brackets indicate totals calculated at 1996-97 prices. See Ninth Five Year Plan, 1997-2002, Volume II, Government of India, p. 468.

5. Of the 16 states which sought assistance, Uttar Pradesh topped with a request for Rs 21,390 million. See B.S. Nagaraj, 'States want Crores there's not a Paisa', *The Indian Express*, 7 December 1998, Delhi edition.

While the Indian subcontinent is, undoubtedly, naturally endowed with inundation prone flood plains, deltas and voluble hydraulic regimes sensitive to a skewed rainfall pattern,[6] anthropogenic activity over the years has been no less significant in heightening and aggravating flood impact – notably population pressures in vulnerable zones, deforestation, drainage congestion caused by roads and railways, urbanisation and reclamation of flood cushions and so on. These factors, however, at best, provide only a partial explanation for the state's continued failure to minimise flood devastation. Much of the crisis can, in fact, be traced to the strategy for flood control itself, at the heart of which today is an overt reliance on flood insulation embankments and large dams.

On the flip side, flood control was and is not necessarily the only viable response to floods. A clutch of studies besides historical evidence now suggest that inundations, in many parts of the Indian subcontinent, were tapped with innovative agricultural practices. William Willcocks' seminal essays on inundation irrigation in the Bengal delta for example, are instructive. According to him, the muddy crest waters of the annual inundations that carried silt and fish eggs were leached through a sophisticated system of channels. While the silt helped nourish and fertilise the soil, the eggs soon spawned and the fish voraciously devoured mosquitoes. In effect, inundations helped fertilise the soil, check malaria and enabled the general build up of the cultivable land above the river beds.[7] In the flood plains of West Punjab (today's Pakistan) the alluvial lands inundated by *sailab* (silt) and referred to as *hithar* were much valued.[8]

In the Bangladesh delta a whole host of techniques, adaptations and practices have been and continue to be in operation to mitigate the effects of floods and, alternatively, even utilise them. Cultivators, based on their traditional knowledge about the timing and periodicity of the floods, have developed elaborate

6. The seriousness of the flood problem increases from the West to the East and from the South to the North. See Report of the High Level Committee on Floods, Vol. I, Ministry of Irrigation and Power, GOI, 1957, p. 10.

7. Sir William Willcocks, The Restoration of the Ancient Irrigation of Bengal, Lecture delivered on 6 March 1928, British India Association Hall, Calcutta. idem, Ancient System of Irrigation in Bengal, Delhi, reprint, 1984. Also see, Note by C. Addams Williams on the Lectures of Sir William Willcocks on Irrigation in Bengal together with a Reply by Sir William Willcocks, Calcutta, 1931.

8. Indu Agnihotri, 'Ecology, Land Use and Colonisation: The Canal Colonies of Punjab', *Indian Economic and Social History Review* 33(1),1996, pp. 42-45.

adaptations of crop varieties to varied flood depths.[9] Besides developing rice strains that grow in virtually submerged conditions (often harvested in boats), the cropping regime has been timed to virtually dodge the highest phases of the flood line.

Cultivators, moreover, distinguish between the normal beneficial floods of the rainy season which are termed *barsha*, and harmful floods of abnormal depth and timing which are termed as *bonna*.[10] 'The normal annual flood (in deltaic Bangladesh) is an ideal event that commences at the right time, lasts for the right duration and has the right magnitude. Thus, three types of floods – early floods, late floods and abnormally deep floods – can cause serious damage to crops as they deviate from the normal flood. A fourth type, a prolonged flood that commences prior to the early limit and recedes after the end limit, may also cause extensive damage.'[11]

Thus, it is the character and nature of the flood rather than flooding *per se* that distinguishes between benign effects and devastation. Needless to add, a blanket attempt to control all types of *floods* is akin to throwing the baby out with the bathwater. Much of the flood damage in India today, in fact, results from the sudden ferocity of the waters compounded by a protracted and prolonged stagnation.[12] This tendency is undoubtedly the product of two obvious factors: the severely constrained or limited area within which floods can now spread and second, drainage congestion.

As opposed to a vast spread with gentle currents, flood waters increasingly are being bottled up by embankments, roads, urban construction and so on which then build up pressure and cause violent currents. Flood cushions such as lakes, *bhils*, *chars* and other such depressions which absorbed a great deal of the excess precipitation have been thoughtlessly reclaimed for agricultural purposes. On similar lines the complex and intricate drainage networks that helped in a quick and effective discharge of the water are now clogged and in various stages of desuetude. The result is the inevitable aggravation of the flood impact which fuels the vicious cycle of further investments in flood control works.

It is important to underline that the transformation of the plains and deltas in the Indian sub-continent from a flood dependent to a flood vulnerable relationship needs to be examined in an historical perspective. This exercise is essential for two reasons: (*a*) to challenge the simplistic and erroneous conclusion that bad planning and population pressures are solely responsible and (*b*) to establish the specific political economy that helped constitute and today reinforces ideas and measures for flood control.

The first coordinated attempts on a large scale at insulating lands from inundating rivers began with colonial rule in the Bengal delta in the latter half of the 18th century. The East India Company upon drastically re-ordering the mode of revenue collection, property arrangements and the social coordinates of administration was compelled to jettison the far more flexible response towards deltaic inundation that had been in prior operation. This rigidity in the new practices of the colonial revenue administration soon shaped the official view on inundations. Instead of perceiving the annual and recurrent excesses of the riverine system's hydrology as *geomorphologic processes* intrinsic and essential to the delta's ecology, the emphasis now veered towards treating the phenomenon as *calamitous events*. In other words, imperatives of rule and administration were decisive in coalescing and organising an agenda for flood control.[13]

Embankments or levees were the first structural measures resorted to for preventing flood-spill from overtopping revenue paying lands. By the mid-19th century far more sophisticated alignments and embankments of greater heights and lengths were being constructed across Bihar, Bengal, Orissa and on parts of the southern rivers.[14] From elemental attempts at securing the revenue demand, ideas on flood control now extended to weighty enquiries on the hydraulics of river behaviour, management and control. According to the dominant perception held in this period, embankments built on either side of the river bank, almost as a straight-jacket of sorts, would enable the river's current to accelerate and keep its bed clear, thereby containing

9. M.Q. Zaman, 'Ethnography of Disasters: Making Sense of Flood and Erosions in Bangladesh', *The Eastern Anthropologist* 47(2), April-June 1994.

10. James K. Boyce, 'Birth of a Megaproject: Political Economy of Flood Control in Bangladesh', *Environmental Management* 14(4), 1990, New York, pp. 419-428.

11. Harun Rasid and Bimal Kanti Paul, 'Flood Problems in Bangladesh: Is There an Indigenous Solution?' *Environmental Management* 11(2), 1987, New York, p. 168.

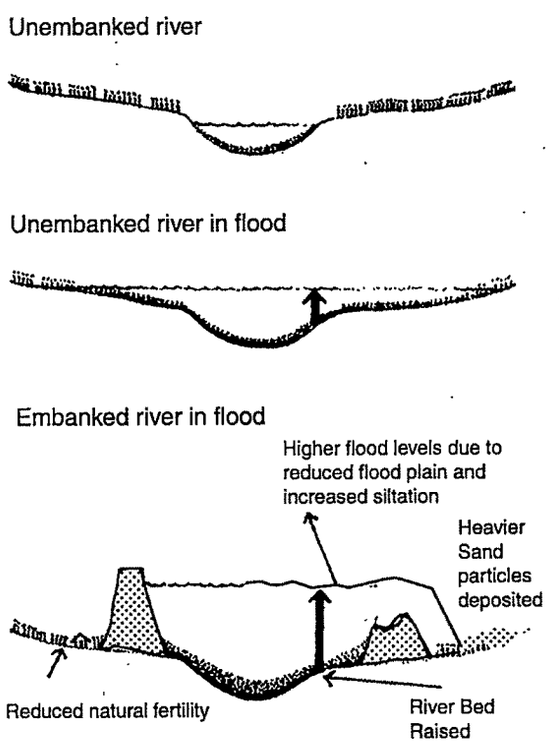
12. See for example *The Troubled Waters: A Report on the 1998 Floods in Eastern Uttar Pradesh*, Independent People's Commission on Floods in East U.P., Poorvanchal Gramin Vikas Sansthan, Gorakhpur, 1999.

13. See Rohan D'Souza, The Deltaic Rivers of the Bengal Presidency: The Political Economy of 'Flood Control' in Colonial India, Doctoral Thesis, Centre for Historical Studies, Jawaharlal Nehru University, 1999, pp. 25-72.

14. See W. A. Inglis, The Canals and Flood Banks of Bengal, Bengal Secretariat Press, Calcutta, 1909.

the high flows within the channel and preventing it from overspilling onto the surrounding lands.

Experience told otherwise. In the latter half of the 19th century a rising tide of criticism is evident in both engineering and administrative reportage and studies. Embankments, it appears, not only clogged drainage, aggravated flood heights and dislocated agrarian production, but also excited substantial resistance in the form of embankment cuts from the local cultivators. To make matters worse the costs of construction and maintenance of these bunds soon became a substantial drain on the resources of the government. In sum, they proved to be as counter-productive as the flood damage they were intended to mitigate.


Unembanked river
Unembanked river in flood
Embanked river in flood
Higher flood levels due to reduced flood plain and increased siltation
Heavier Sand particles deposited
Reduced natural fertility
River Bed Raised

Impact of the Embankments: Higher Flood Levels and Faster Currents

The flood plain, prior to being embanked, is largely prone to low intensity floods in which the river's relatively slow current deposits lighter silt on the land. When embanked, however, the flood level increases, the river's bed rises from constant deposition and the heightened pressure on the embankments can lead to a burst. Unlike the low intensity flood of the pre-embankment stage, where the spread of the water is gradual and the difference between the flood plain and the river bed is not very abrupt or steep, floods caused by embankment burst are usually of a high intensity with faster currents and therefore more devastating. The faster currents carry heavier particles like sand and can render cultivable fields unproductive.

Not unexpectedly, in the early decades of the 20th century, the colonial government initiated a general policy for abandoning wherever possible its responsibility towards flood insulation. This period of minimalist intervention is best encapsulated by the famous report of the 1928 Flood Committee, constituted to deliberate on the Mahanadi floods of 1927. After an exhaustive set of surveys and field level exposure, the committee concluded that in the case of Orissa, the annual deltaic inundations were a part of the 'workings of nature' and consequently all attempts to control them were an obstruction to the play of geomorphologic processes. The 1928 committee, in addition to its unprecedented diagnosis, perceptively noted that the problem was not how to prevent floods but how to pass them as quickly as possible to the sea.[15] This understanding translated into a general critique of embankments and all 'obstructions' that militated against the speedy drainage and extensive spread of the flood waters.

The landscape had, however, been completely rewritten by this time. Considerable interests who benefited from 'protection' had developed in vast stretches of the subcontinent. A century of tampering with the natural drainage and reconfiguring the topography and agrarian production regimes to suit exigencies of rule and administration had led to the creation of several 'protected enclaves', substantially insulated from flood-spill. These protected zones, surrounded by embankments, were now decisively committed to the continuation of the embankment system as many of them had sunk below the beds of the rivers.

On the other hand, the unprotected and semi-protected areas now bore the full brunt of the floods ferocity and pressed hard for the removal of these obstructions. Caught thus in a virtual quagmire of irreconcilable antagonisms and conflicting interests, the colonial government found itself in a bind vis-à-vis attempting to undo the flood control strategies of the past. Consequently, even though the dominant professional and administrative opinion throughout the early decades of the 20th century was against flood control in general and the embankments in particular, political and social impediments gave short shrift to any radical attempts at manoeuvring away from a policy of protection.

The early 1940s witnessed a new set of initiatives for flood control technologies in India. Devastating floods in the Damodar delta in 1943 raised, for the first

15. Report of the Flood Committee 1928, 2 vols, Government of Orissa and Bihar, Patna, 1929.

time, the possibility of controlling floods, besides harnessing them for hydro-electricity and irrigation, through large multipurpose dams. The momentum subsequently acquired for their adoption, however, was premised not, as would be expected, on grounds of ecological viability and technical feasibility, but instead on the new political and economic conjuncture that underpinned India's independence.

In the immediate aftermath of the Second World War, the Indian economy was in a bind of sorts. On the one hand, a revenue surplus had been generated from a spurt in war time production; on the other, the end of hostilities meant that a huge demobilization of the army would take place fuelling unemployment, which would be further complicated by an overall fall in demand. Consequently, the idea of attempting to pump prime the economy, i.e., raise effective demand through increased government spending, gathered support from the ruling establishment. In such a scenario large projects became the natural choice to soak up reserve labour and utilise the excess war time quotas of cement and steel.

Meanwhile, the United States of America in this period became a front-runner in the export of flood control technologies via the Tennesse Valley Association (TVA) projects. The comprehensive 'harnessing' of the river system for hydro-electricity, irrigation and flood control was in fact being aggressively touted by their political leadership as the most significant and necessary step for development the world over. In the words of David Lilienthal, then chairman of the TVA: 'The lessons of the unity of resource development [was] the close inter-relation between electricity and industry, between industry and farming and the building of the soil, between the soil and flood control.'[16]

Undoubtedly, damming rivers for multiple uses must have also translated into bread and butter possibilities for a number of contractors, exporters of capital goods, industrial conglomerates and perhaps politicians as well. The rhetoric supporting the need for large dam construction and flood control reservoirs, therefore, was very substantially grounded and driven by the need to address vested economic interests. This fact needs to be reiterated in the light of attempts to limit the critique of the 'romance' with large dam construction as essentially stemming from misplaced confidence in technical solutions or from engineering hubris.

In India, between 1945-48, a number of multipurpose dams to enable the control of the Damodar, Mahanadi and Kosi rivers were quickly approved. In the case of the Hirakud dam over the Mahanadi river especially, undue haste was shown in clearing the project. Barely four months elapsed between the decision to dam the river (8 November 1945) and the first foundation stone ceremony (15 March 1946). Studies ascertaining the technical feasibility of the project were completed only a full year later.[17] Opposition, wherever encountered, was ruthlessly swept aside, both by recourse to falsely raising high expectations about the likely benefits and by repeatedly derailing criticism.

One such critique of the Hirakud dam by R.M.G. Rangaiya, then retired chief engineer and secretary PWD of the Mysore state, published in August 1947, was skillfully suppressed. Rangaiya's report, besides pointing out many lacunae, noted that the Hirakud project was proceeding on a very thin number of surveys.[18] In sum, it appears that the introduction of multipurpose dams for flood control in India was intended to articulate with certain economic and political agendas rather than genuinely address the issue of floods.

In 1993, massive flooding along the Missouri and Upper Mississippi – two of the most dammed and embanked rivers in America – took at least 38 lives and caused damage costing an estimated $12 to $16 billion. The magnitude of the destruction was stunning, coming as it did after the U.S. Army Corps of Engineers had expended over $25 billion on 500 dams and 16,000 km of embankments (since 1937). The writing was, in fact, already on the wall with annual flood damage to property in the U.S. averaging around $3 billion in the first half of the 1990s.[19]

Flood control since then has drastically lost its appeal among the technocracy and decision-makers in the first world. *Flood management* has now become the new *mantra*. The logic has been reversed, i.e., instead of keeping floods away from people the emphasis is now on keeping people away from floods. Attempts are now directed at non-structural responses such as warning systems, attending to problems of soil erosion, flood plain zoning, renewing wet lands and so on. While clearly the propagandists for extending the idea of the TVA[20] are on the retreat, the Asian sub-

16. David Lilienthal, *TVA: Democracy on the March*, New York, 1966, reprint, p. 137.

17. See A.N. Khosla (ed.), *Mahanadi Valley Development Hirakud Dam Project*, Simla Press, June 1947.

18. R.M.G. Rangaiya, Mahanadi Valley Development, Hirakud Dam Project, Bangalore, August 1947.

19. Patrick McCully, *Silenced Rivers: The Ecology and Politics of Large Dams*, Zed Books, London, 1996, p. 146 and 193.

20. The TVA was $27 billion dollars in debt in 1998. See Patrick

continent is witnessing a contrary pull. Two of the largest 'development' projects in the region are flood control projects. In China, construction on the gargantuan Three Gorges dam over the mighty Yangzte is in full swing. On the other hand, Bangladesh is currently, through the 'largesse' of international donors, exploring possibilities of straight-jacketing the Brahmaputra-Meghna-Ganga delta with several thousand kilometres of embankments.

Decades of experience with the failures of dams and embankments is being deliberately and criminally ignored in the case of the above mentioned two projects. Flood control reservoirs, for example, are inherently plagued with conflicting demands for their use. While storing peak flood discharge needs an empty reservoir, demands for irrigation and hydro-electricity require the opposite.[21] This tension often leads to gross miscalculations in the operation of the reservoir space and on instances has led to dam induced floods. Mechanical problems can result as well. In a number of incidents, spillways have been found to be unusable at peak discharge periods because of debris jams, cavitation damage, downstream scour or an inability to access control.[22]

The list of problems following embankment construction is even more debilitating. Besides clogging drainage, causing unusual sediment build-up in the river beds and increasing the flood line, embankments require costly maintenance and often need to be repeatedly raised. In northern Bihar a popular movement against the embankment system is fast acquiring appeal and cohesion. The Barh Mukti Abhiyan, through its agitations and reports has drawn a horrifying picture of the realities within and outside the embankment zones. Embankments, it argues, *transfer floods* rather than insulate the land from them. Large parts of north Bihar are now divided into protected, semi-protected and unprotected enclaves with the interests of the respective communities antagonistically poised.

Lands which have sunk below the level of the river beds need embankments, while those communities bearing the brunt of the ricocheting flood waters attempt to cut these structures during peak flows. Violence therefore has become central to life in the embanked areas. Productivity has suffered as well. While, on the one hand, the fertile silt laden waters have been prevented from nourishing the land, on the other, the drainage of the cultivated lands has been severely disrupted. Thus, large swathes of land now remain permanently water-logged whereas prior to the embankments they were inundated for only a brief period.[23]

With the lives and subsistence of millions of people in the Indian sub-continent closely intertwined with and dependent upon the river regimes, a viable response to floods is a critical need. Flood control is clearly not a sustainable proposition and alternative options such as a *comprehensive system of drainage* need to be explored in right earnest. In effect, a complete reorientation is required in which instead of bottling up the inundating waters the emphasis is directed at speedily jettisoning them away via a plexus of drainage lines.

The attempt, however, to roll back decades of dam and embankment centred strategies is not solely a question of displacing one technical perspective with another. Much effort will, in fact, have to be directed at mobilising politically in order to undermining the multiple levels at which vested interests have acquired a stake in the continuance of the current flood strategy.[24] In sum, central to challenging the notion of flood control is the question of addressing the genuine democratic aspirations of the people at large and redefining the content of 'development'.

ROHAN D'SOUZA

McCully, 'Big Dams: Time to Reassess the Faith', *The Ecologist* (Asia) 6(5), September-October 1998, pp. 15-16.

21. The four dams built on the Damodar river by the Damodar Valley Corporation (DVC), once hailed as India's version of the TVA, were originally conceived primarily as flood control works. Fifty years down the line, however, an over-emphasis on power generation has severely curtailed their role as flood reservoirs. See Chinmoy Thakurta, 'Could do Better, but for Funds', *Statesman*, 7 July 1998, Delhi.

22. Philip Williams, 'Inviting Trouble Downstream', *Civil Engineering*, February 1998, pp. 52-53.

23. See the Proceedings of the Second Delegates Conference (5-6 April 1997) of the Barh Mukti Abhiyan, Patna, 1997 and Proceedings of the Seminar on River Crisis in South Asia (21-22 June 1998), Barh Mukti Abhiyan, Patna, 16 September 1998.

24. It is interesting to note, for example, the scramble over contracts for the Three Gorges dam in China. In 1985 a high powered consortium called the Three Gorges Working Group was formed in the United States to lobby for engineering contracts. Members of the group included the U.S. Bureau of Reclamation, U.S. Corps of Engineers, Bechtel Civil and Mineral, Coopers and Lybrand, Merrill Lynch Capital Markets and many others. This was quickly followed by a similar lobby in Canada, which proved to be far more successful. The Canadians organised as a consortium called the Canadian International Project Managers Ltd (CIPM) Yangtze Joint Venture. Besides including three private companies like Acres International, SNC and Lavalin International, state utilities such as Hydro Quebec and British Columbia Hydro also joined in. See for details Grainne Ryder, *Damming the Three Gorges: What Dam Builders Don't Want You to Know*, Probe International, Ontario, n.d.

Flood control vs flood management

PHILIP B. WILLIAMS

ON the night of 30 July 1993, the rising waters of the Missouri river washed out yet another embankment. This time it was the Monarch-Chesterfield levee, which protected a former floodplain in the town of Chesterfield, a St. Louis suburb. Instead of submerging crops and farmhouses, however, the river inundated an entire new light industrial park, the economic centre of the town, to depths of up to 2.7 m causing $200 million worth of damage. The failure dramatized what many flood managers have argued for decades, that building flood-control structures without setting effective land use controls often results in increased flood damage.

The U.S. investment in structural flood-control works now exceeds $25 billion, yet according to the 1992 Federal Interagency Floodplain Management Task Force, flood damages have been steadily increasing and now average more than $2 billion a year. The reason damage continues to escalate is that many communities have allowed a strategy of flood control to substitute for effective flood management.

The goal of flood control is to eliminate floods by building structures such as levees and dams. The underlying assumption is that once the structure has been built, the problem has been handled; maintenance and monitoring become low-priority concerns. In contrast, the goal of flood management is to reduce the hazard to lives and property by the most cost-effective measures, recognizing that not all flood risks can be eliminated. The underlying assumption is to commit to long-term management of all factors that affect flood risk. This requires a management system that

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includes clear objectives, accountability, monitoring and the ability to change policy in light of new information.

When a region relies exclusively on flood-control structures instead of using them as one of many possible components of a flood-management strategy, there is a tendency to believe that the flood danger has been eliminated and to disregard other risk management methods such as elevating structures. This can result in increased damage when flooding occurs, because the property at risk is now more valuable and the increased damages can outweigh the benefit of less frequent flooding afforded by the project.

For example, the Monarch-Chesterfield levee was a Federal Emergency Management Agency (FEMA) approved structure that was upgraded in the early 1980s to provide protection against the estimated 100-year flood. Believing that the area was now floodproof, the town of Chesterfield had encouraged high-value development in what inevitably was still a flood-prone area. When flooding occurred, the damages were significantly higher than they would have been if the levee had never been built.

Further, natural flooding tends to be gradual and predictable, whereas when a levee fails or a flood-control reservoir spills uncontrollably, the effect is catastrophic. In these circumstances, the flood wave can be rapid, unexpected and unpredictable, inundating a floodplain where warning systems, high ground refuges or evacuation routes may have been neglected. A 1987 FEMA study estimated that about one-third of U.S. flood disasters are now caused by levee overtopping or failure.

The 1993 Midwest floods illustrated this conflict, rekindling a debate that goes back to the 1850s, when Congress commissioned engineer Charles S. Ellet to study the Mississippi and undertake the nation's first river management plan.

In his 1851 report Ellet recommended that large areas of the Mississippi floodplains be used as flood storage and overflow areas. However, in 1861, Congress accepted the conclusion of his contemporary, Andrew A. Humphrey, a captain (and later general) in the U.S. Army Corps of Engineers. Humphrey recommended embanking the Mississippi river in a single channel, isolated from its floodplain. Humphrey's ideas not only established the Corps as the pre eminent U.S. authority on rivers, but have also greatly influenced river management in the U.S. and the world ever since.

Underlying these ideas was the 19th century's view of engineering, expressed by Thomas Tredgold as the 'art of directing the great Sources of Power in Nature for the use and convenience of man.' Flood-control engineers were established as de facto river managers and since then the institutions and methodologies of flood policy have developed to support them.

The dominance of the structural idea has completely transformed most of the rivers and wetlands of the U.S., from the drainage of the Everglades to the embankment of the Sacramento river. Behind the structural idea has been the drive to increase the utility – primarily for farming – of the rich, flat, floodplain land.

This transformation, which has occurred on rivers around the world, has had a huge environmental cost. The destruction of riparian wetlands and fisheries, the deterioration of water quality and disturbance of the natural river morphology all devastated ecosystems and is now recognized to have had significant economic costs. But in 1926, environmental values were ignored or discounted and the growing faith in the infallibility of flood control led the Corps to claim that 'the Mississippi is safe from serious flood damage.'

The nation's worst flood disaster occurred on the Mississippi the very next year. It flooded out 700,000 people but did not shake confidence in structural flood-control strategies. It did, however, stimulate a redoubled effort to design more effective structures, and led to the flood-control acts of the 1930s, which encouraged the construction of flood-control reservoirs. Those who questioned the cost and effectiveness of the massive federal investment in flood control were outweighed by public support for job creation schemes in the Depression and by congressional pork-barrel politics.

Nevertheless, the ideas of one critic, geographer Gilbert White, started to take hold. White's 1945 dissertation, 'Human Adjustment to Floods' and subsequent papers from the University of Chicago and the Natural Hazards Research Centre posed the question: What is the real purpose of flood control? For an individual farmer it might be to minimize crop damage and for a riparian landowner it could be to increase property values, but for society at large and for taxpayers who pay for projects, it should be to reduce flood hazards to an acceptable level.

This answer implies a way of treating rivers by managing, instead of controlling floods. The goal of flood management is to alleviate existing and future hazards to lives and property in the most cost-effective ways. This can be accomplished through structures or other means such as zoning, floodproofing, flood warning and financial incentives.

Over the past 60 years, acceptance of these ideas has grown, leading to new national policy initiatives. In 1973, for example, the U.S. began a flood insurance programme that shifted the burden of disaster relief from the federal taxpayer to those who occupy flood prone lands and encouraged local governments to adopt nonstructural flood-management strategies.

The inherent conflict between flood control and flood management has not yet been resolved. The language of flood management has been adopted by most government agencies, but flood control is still the dominant paradigm for many politicians, engineers and the public. That nonstructural flood management is still defined by what it is not bears this out.

The 1993 Midwest flood may change that bias because the media and the public's attention has been focused on a new fundamental question: How effective is structural flood control?

The performance of traditional flood-control structures in the last few decades is disturbing. Most have been in place less than 50 years and are designed for at least the 100-year event. But the few times they have been tested, many have failed to handle events below the level of their design flood. For example:

* The 1973 flood on the upper Mississippi showed that flood crests at St. Louis were up to 3 m higher than for an earlier flood of the same size because of the constricting effect of upstream levees. During the record 1993 flood, the Corps acknowledged that the floodwall protecting St. Louis may only have survived because unplanned upstream levee failures reduced the flood stages near the city.
* The concrete flood-control channel of Corte Madera Creek in Marin County, Calif., designed for the 200-year flood, over-topped its banks in 1982 and 1986, while conveying less than the 15-year flow. A subsequent Corps review determined that the transport of bed-load sediment had a significant adverse effect on flood hydraulics. Throughout the U.S. and around the world, concrete flood-control channels have been constructed using clear-water flow assumptions. Channels that will carry large amounts of bed load during their design flood will now require re-evaluation.
* The 1986 flood on the American River came close to flooding out Sacramento, Calif., which relies on the protection afforded by levees and a major flood-control reservoir, the Folsom dam. Although the flood was well within the design capacity of Folsom, operational errors allowed the reservoir to fill, requiring releases exceeding downstream levee capacity. Subsequently, the Corps downgraded the effectiveness of Folsom, arguing for a new flood control reservoir upstream at Auburn. When this proposal was defeated in 1992, a National Academy of Engineering panel was set up to evaluate key technical flood control criteria, a study that could prompt a re-examination of the real benefits of flood control reservoirs elsewhere.
* The 1980 flood on the Los Angeles river showed that design flows had been under-estimated by at least 30% due to urbanization of the watershed. Portions of the U.S.'s largest concrete flood-control channel are now estimated to have only 25-year flood capacity. Half a million people live in the 100-year floodplain and a $340 million reconstruction project is being considered by the Corps.

These experiences have turned attention back to the hydrologic benefits of restoring floodplains, which can be achieved by relocating flood-prone property and removing or setting back levees. However, there are significant institutional and technical barriers to implementing these ideas.

Institutional barriers exist because no single federal agency has a mandate for flood management that is equivalent to the Corps' clear mission to provide flood control. Technical barriers exist because current flood control methods do not recognize the benefits of watershed management or floodplain storage. For example, HEC-2, the programme used by almost all agencies for computing flood crests, is a steady-state model that does not take into account the dynamic storage effect of floodplains on reducing flood peaks. Consequently, it offers little incentive to protect or restore floodplains from filling or embankment.

However, there are promising signs. In 1992, the National Research Council recommended the restoration of 400,000 m of rivers and streams over the next 20 years; this partly to offset damage due to river engineering works. And following the 1993 Midwest flood, the U.S. Fish and Wildlife Service has proposed a plan to move back 750 m of Missouri river levees to alleviate flooding and restore ecosystems.

The same issues confronting the U.S. are also being debated in Europe, where there is a belated but growing recognition that flood control can conflict with flood management. Like the upper Mississippi, the Rhine has been straightened and embanked for navigation and flood control over the last 120 years. However, it is now recognized that making the Rhine's floodplains into protected farmland has accelerated the passage of floodwaters, aggravating the damages that occurred in the December 1993 flood, the worst the region had seen since 1926. Peak flows from tributaries such as the river Main now coincide with

Rhine flood peaks, increasing hazards to the industrial Ruhr where the 200-year flood has become a 60-year event.

To reduce this risk, German and French flood-control agencies are retrofitting the massive Rhine embankments with siphons to divert some of the flood peak into gravel pits behind the embankments. This attempt to create artificial floodplain storage is criticized by some river managers who argue that the same benefits could be achieved – with substantive environmental improvements – by directly restoring the remaining portions of the river's natural floodplain.

Many agencies in Europe and the U.S. appear to be at a turning point, but in other countries the lessons of flood management have yet to be recognized, and some of the world's largest and most expensive flood-control projects are in the planning or construction stage.

In China, the world's largest hydroelectric power plant, the Three Gorges Dam Project on the Yangtze (also called the Chang Jiang), is primarily being promoted in public as the means for controlling Yangtze valley floods. These floods have caused enormous damage and loss of life. Over the last 40 years, Chinese river engineers have reduced these flood hazards by developing a sophisticated flood management system of embankments, overflow weirs, diversion areas and floodplain lakes – similar to Ellet's vision.

Because of the huge flood volumes on the Yangtze (200 km^3 in 1871) and the Three Gorges dam's location above major tributaries, the 22 km^3 flood storage within the reservoir would have a relatively minor effect on flood stages during many large events. In tacit recognition of this, a Canadian feasibility study determined that the economic flood-control benefit is almost entirely attributable to the protection of people who would settle between the existing levees or within the flood diversion areas. Unfortunately, when flooding occurs, a disaster many times worse than Chesterfield is easy to envisage. The Chinese government also assumes the dam will be operated perfectly, drawing down the reservoir at the beginning of the flood season and storing the flood peaks. Based on the operating experience of other reservoirs such as Folsom, this is unlikely.

Even disregarding the conflict between operating the dam for profitable power generation and the less tangible flood benefits, the operators of Three Gorges will face a unique dilemma. To save costs on the project, for which at least 1.1 million people will have to be relocated, hundreds of thousands of people will remain in the active flood-control pool and back water areas. During a major event, the operators will have to balance the certainty of flooding these people against the uncertainty of protecting more people downstream.

In addition, Chinese experts, whose opinions have now been suppressed by the Chinese government, argue that it is likely that flood hazards will actually be increased by allowing the Three Gorges project to supersede the existing flood-management system. With the massive expenditure of constructing the dam, it will become harder to raise money for the continued maintenance and management of the levees downstream. At the same time, by capturing the Yangtze bed load, the dam will induce channel downcutting and migration that could destabilize critical levee systems that protect millions of people.

In Bangladesh, the World Bank is coordinating studies for what is intended to be the world's largest flood-control project – the $10-20 billion Bangladesh Flood Action Plan to embank all the major rivers in Bangladesh. Most of Bangladesh is a floodplain whose rich soils depend on regular inundation from the monsoon floods to grow food for the nation's 110 million people. Over many centuries the rural population has adapted to and used the floods. For example, they build their villages on raised mounds and plant fast-growing rice that keeps pace with rising flood waters. The idea of flood control is comparatively recent here and was originated by a U.S. Agency for International Development (AID) study that was completed for Pakistan in the 1950s.

This study essentially recommended replicating Humphrey's vision for the Mississippi river in Bangladesh. By the 1980s, individual aid projects had completed about half of the embankments, but with unanticipated adverse results. The embankments were effective at preventing smaller floods but ineffective against the large floods that cause river channels to shift and can scour the riverbed to depths of 46 m.

By reducing the frequency of inundation, the embankments also reduced soil fertility, requiring the use of artificial fertilizers. These effects caused a catastrophic decline in the floodplain fisheries that provided Bangladesh with its main source of protein. Flooding is now less frequent but more sudden and a new problem has emerged: the embankments interrupt natural drainage, aggravating local flooding and sometimes must be demolished to allow trapped floodwaters to escape.

In 1988, a record river flood in Bangladesh inundated large areas of the capital, Dhaka, including the airport

and embassy areas. This led foreign governments and aid agencies to propose enactment of the Flood Action Plan which emphasized rapid completion of the structural measures. A flood-management approach proposed in a new AID 'Eastern Waters' study was overruled and planning was initiated under World Bank leadership.

Independent Bangladeshi experts have long argued that the highest priority in flood management should be to alleviate the hazards caused by the devastating cyclone-driven storm surges that regularly kill hundreds of thousands on the coast of the Bay of Bengal (by comparison, about 3,000 died in the 1988 river flood). Cyclone flooding measures only receive about 2% of the Flood Action Plan's budget, possibly because large-scale structural flood control works are clearly infeasible and implementation of effective measures such as warning systems, refuges and disaster relief systems are of secondary importance to flood-control – as opposed to flood management – strategies.

In the last few years, however, with the advent of democracy in Bangladesh, and now with the experience of the 1993 mid-West flood (which was broadcast extensively in Bangladesh), there are signs that after $150 million spent on studies and design, the World Bank will concede that the original plan was mistaken. Further, the continuation of the Three Gorges project seems dependent on suppressing public debate, a stance that China may not long be able to maintain. With these developments and the rethinking of flood policy strategies in the U.S. and Europe, it appears that we are finally ready to give up the vanity of attempting to control floods, and instead concentrate on how we can best live with them and manage our rivers wisely.

Reconceptualising mitigation

AJAYA DIXIT

IN March 1998 a group of researchers, development workers and local activists from Nepal and India completed a week-long hike along the Rohini river. This river and its tributaries originate in the Churia hills in Nepal and flow southward to join the West Rapti river near Gorakhpur in India. The Rohini flows between Lumbini, Nepal, where Lord Buddha was born and Kushinagar, the town east of Gorakhpur where he attained *moksha*.

During the walk the team visited communities which live along the river in order to get a first-hand understanding of how floods affected them, and how they coped with the hazard. The trip was part of a collaborative research effort to improve understanding of the vulnerability of communities living near a small trans-boundary river to floods.[1] This region experienced one of the most severe floods in its recent history. In 1998 torrential monsoon rains led to devastation in west central Nepal and eastern Uttar

1. The hike was the first leg of an ongoing collaborative research project. The organizations participating in the research are People's Science Institute, Dehradun: Nepal Water Conservation Foundation, Kathmandu; Vikalp, Gorakhpur; and Gandak Water Users Association, Nepal. In 1998, seven rainfall stations were established in the upper catchment of the Rohini river and two in the lower catchment. The study is supported by Oxfam, Lucknow and Oxfam, Kathmandu.

Pradesh; Bangladesh recorded its worst flooding in recent years. The states of Bihar and West Bengal were also affected.

Had the team any inkling of what the moonsoon was to bring that year, could they have advised the people how to cope with the hazard? What kind of forecasting or warning arrangement would have provided enough lead-time for the villagers to take precautionary measures and what could they have done to make themselves secure? Would multipurpose projects have offset such a flood in the region? These are some of the questions we have explored through our collaborative research.

Floods are a common phenomenon in the Himalaya-Ganga, the high-land low-land interactive system of the Ganga river system. Every monsoon landslides, swelling rivers and floods take a heavy toll of properties and lives. The region is susceptible to floods because of one or a combination of the following natural factors: continuous rainfall and cloudbursts, snowmelt and rainfall combine, snowmelt, glacial lake outburst floods, *bishyari* (the breaking of dams caused by landslides falling directly into river channels), and breaching of lakes and man-made reservoirs.

One major cause of floods is hydro-climatological. The monsoon rain, which lasts from June to September, is marked by large regional and temporal variations. The rainfall is sharp and intense. The date of onset, and the magnitude, duration and intensity of rainfall vary at macro, meso and micro scales. For example, the amount of rainfall in the eastern, central and western Himalaya are different. The eastern region is wetter than the west. In the rain-shadow regions of the Tibetan plateau, conditions are dry and desert-like. In the mountains, orographic effects cause large local variations within a valley. Sudden cloudbursts, which account for almost 500 mm of rainfall in a single day, are common.

In the Kulekhani catchment in 1993, 540 mm rainfall was recorded in a 24 hour period. In 1998, the rain gauges installed in the catchment of Rohini recorded 3200 mm of rainfall in the three months from June to August, almost double the average rainfall recorded in the nearby stations over the last several years in the same period. On 3 August one of the rain gauge stations recorded a rainfall of 459 mm in 24 hours.[2]

In Nepal the monsoon and the Himalayan mountain system give rise to about 6000 rivers of varying length. The rivers can be broadly categorized into three types: snow-fed, rain-fed originating below the snow line, and rain-fed originating in the southern face of the mountain chain and the plains. Mahakali, Karnali, Gandak and Kosi are the main tributaries of the Ganga and originate in Tibet and the Nepal Himalaya. The Ganga river and its major tributaries also function as drainage channels.

In the four major river basins in Nepal –Mahakali, Karnali, Gandak and the Kosi – rivers are perennial and derive their flow from monsoon run-off and snow-melt. There are six smaller basins, whose headwaters originate in the middle hills and whose low season flows are not augmented by snow-melt. These are the Babai, West Rapti, Bagmati, Kamala, Kankai and Mechi. The East Rapti, Arung, Andhi Khola and Trijuga have hydrological and morphological characteristics similar to those of the rain-fed rivers. They join the main rivers of the larger basins and are classified as tributaries of these larger rivers.

The Tarai is criss-crossed by several smaller rivers which originate in the southern slopes of the Churia hills and flow southwards into India. These rivers can be divided into six blocks: the Dhangadhi group in the far west, the Lumbini group, the Birganj group, the Janakpur group, the Rajbiraj group and the Biratnagar group. All rivers flowing from Nepal join the Ganga or its tributaries in Uttar Pradesh, Bihar and West Bengal. The hydrology of rivers generally follows the pattern of rainfall. From July to September the rivers experience high flow; from October to November a period of decreasing flow ensues. From December to April the flow is low. Pre-monsoon rains, snowmelts and thunder squalls increase flow in May. With the commencement of the monsoon in early June the flow increases.

The Tarai group of rivers is the most capricious and causes the heaviest flood damage. The southern slopes of the Churia hills receive some of the heaviest and most intense rainfall in the country. The rainfall results in high run-off in stream channels which exhibit marked variation in flows. The peak monsoon flow of these streams can be a thousand times greater than its lowest flow. Some of these rivers are dry during the winter season, while in the monsoon they become active and cause immense damage.

The large rivers also exhibit seasonal variations. Even in rivers such as the Kosi the fluctuation can be sudden and high; a rise of 20 to 30 feet in 24 hours in its gorge is not uncommon. Incessant rain in the catchments leads to floods. For example, the highest and second highest floods in the Kosi which occurred in 1954 and 1966.

2. See Dixit and Dahal (1999) for an analysis of the 1998 monsoon events in the upper Rohini catchment. The three months of June, July and August recorded 3200 mm rainfall. The normal rainfall in the region during the same period was 1502 mm.

were the result of long duration rainfall in its catchment. In the smaller streams the impact of flooding is more localized, but it can become widespread depending upon the magnitude, extent and duration of the accompanying rainfall. At the end of the monsoon, when the land is saturated, the contributions of cloudburst to overland flow is almost hundred percent, and cloud burst can lead to devastating effects as the recent flooding in the Rohini river indicated.[3]

In the High Himalaya, GLOF (Glacial Lake Outburst Flood) is a regular phenomenon. There are many glacial lakes blocked by the terminal moraine of Himalayan glaciers located above 4000m elevation.[4] Glaciers have retreated rapidly in the latter half of the century, forming in many cases, ice-core moraine-flanked lakes of melt water. Occasionally there is a breach in a moraine dam and a lake empties in a very short time. The result is floods of great magnitude in downstream river reaches. The water carries with it sediment from the moraine dam as well as from the riverbeds and banks gouged out by the flow. The combined action of sudden flooding and debris movement washes away riparian farmland, settlements, infrastructure and many unsuspecting individuals in its wake.[5]

Debris flow resulting from mass wasting and landslides is often released into river channels, temporarily damming them. A dam breach results in a peak flood of short duration. Such an outburst of water and debris, called bishyari, causes heavy damage along the river bank which continues for several kilometers downstream of the point of origin. The flood peak is attenuated when the flood wave hits wider river reaches. As they reach the Tarai plains, rivers deposit their coarser sediment load in the 'inland deltas' and cause them to move laterally. The shifting tendency is common to all rivers. It is most dramatic in the Kosi river which has shifted 150 kilometers westwards in the last 150 years.[6] Intermittently, deposited sediment is washed away in large flood events and is ultimately transported to the ocean.

The occurrence of bishyaris is highly stochastic and does not give sufficient warning time. GLOFs also occur at random, but because the location of a glacial lake is fixed, the regions likely to be affected by a potential GLOF are identifiable. The areas which could be affected by potential GLOFs and bishayris are sparsely populated, and because the number of people killed or hit is small, the intensity of suffering of the affected populace can be masked. Also, since the affected population is in the informal sector of the economy, the losses are weakly accounted for in statistical counts.

Floods in the Tarai, on the other hand, are regular and provide comparatively longer lead-times than those in the hills. In the 1993 monsoon, however, even in the Tarai, the flood event of July was sudden. The flood in the Bagmati river that year reached maximum recorded levels; its suddenness led to the death of about 800 persons in the Sarlahi and Rautahat districts of the central Nepal Tarai.[7]

Human intervention may also alter the hydrological sub-processes and contribute to flooding. Interventions in the flood plain change the upstream-downstream linkages while the introduction of structures like weirs and barrages leads to aggradation in upstream channels and during high flow exacerbates the impact of flooding due to the congestion of the drainage channels. Upland land-use changes may also influence the upstream-downstream linkages of hydrology at the micro and meso scales. A growing body of literature indicates that in the middle hills not just the forest cover but also the hydraulic properties of soil and several other factors determine run-off and flood responses. It has also been argued that terraces on hill slopes contribute to soil conservation and slope stability more effectively than reforestation.[8]

The conventional responses to mitigating flooding are of two types. The first response takes the form of post event relief and the second is structural solutions in the form of multipurpose projects and embankments. In the plains of north Bihar, for example, more than 3500 km of embankment have been built in the last 40 years. The embankments have resulted in the aggradation of channel beds, and consequently the spill over of floodwater and waterlogging. The examples of the Kosi and other embankments in the Ganga plain are cases in point (Mishra, 1997). Due to deposition of sediment the beds of jacketed rivers are at higher level than the adjoining lands. The other solution sought to provide respite from flooding in the lower Himalaya-Ganga has been the creation of reservoirs with multipurpose objectives in Himalayan valleys.

3. Ibid.

4. Active glacier lakes are located between the Kali Gandaki in central Nepal and the Kanchenjunga in the east.

5. For an elaborate discussion on location, causes and lessons of past GLOFs, see Gyawali and Dixit (1998).

6. WECS (1987).

7. See DPTC (1996).

8. For a discussion on the role of vegetation, see Gilmore *et al* (1995) and on impact of terracing on hill slope see Wu and Thrones (1995). A discussion of the debate surrounding 'the Himalayan degradation theory' are found in Chapman and Thompson (1995).

Some reservoirs have been conceived to possess flood moderating capacities.

Multipurpose dams have been on the cooperative agenda of India and Nepal since the 1950s. One initiative, the Integrated Treaty on the Mahakali river was signed in 1996 and set the stage for implementing the Pancheswar Multipurpose Project on the Mahakali river. The other storage option is the high dam on the West Seti, which is proposed as a hydroelectric and not a multipurpose project.[9] Both proposals, however, face disagreements over the articulation of rights to regulated waters even though the Mahakali Treaty proposes sharing benefits commensurate with costs.[10]

The two projects are among the 29 reservoirs proposed in the Nepal Himalaya that would yield a gross storage of 100 billion cubic meters, and a net storage of 61 billion cubic meters.[11] When completed, the reservoirs are likely to yield a year round regulated flow of about 5000 cubic meters and will moderate flood peaks in the downstream river stretches of each site if the operation of the reservoirs is optimized for flood cushioning by leaving space empty for accommodating floodwaters.

In reality, such optimization is not likely to work and provide benefits because the disincentives to leave the reservoir empty are high. Flood water does not yield any revenue to the government. Even irrigation water is a smaller revenue endeavour compared to electricity, which secures highest revenue. There is also a systemic contradiction: the needs of electricity and irrigation require a full reservoir while those of flood control require an empty reservoir to accommodate high flow. None of the reservoirs built so far in the region except the two reservoirs in the DVC project in West Bengal possess flood-cushioning space. Even in these two projects, the original flood cushion capacity was whittled down to accommodate the concerns for electricity generation.[12]

Yet, proposals for building new reservoirs dedicated to flood cushioning continue to be central to regional politics and have acquired prominent focus. Following the 1998 floods in eastern Uttar Pradesh, the media blamed the dams located in Nepal, and the Himalayan kingdom received much attention.[13] Similar reports appeared in the Bihar media. In September of the same year the Indian prime minister visited Gorakhpur and remarked: 'The rivers coming from Nepal are the main cause of the flood devastation in India. The talks with Nepal to build dams are ongoing.'[14] Note that with the exception of the 73 million cubic meter net storage reservoir in the Kulekhani river, none of the other proposed 29 reservoirs have so far been built; nor do dams or diversion projects exist in the region. The erroneous reporting in the media was questioned by activist groups in Bihar, who issued press statements highlighting that there were no dams in Nepal except on the Kulekhani river.

The differences regarding the Pancheswar project and West Seti high dam have not been resolved. Even otherwise the logic of investing in large-scale projects such as Pancheswar remain questionable. One major irritant to adopting large-scale water projects with long gestation period is the mobilization of finances. The preliminary cost of the Pancheswar project is estimated at $3 billion, half of which Nepal is expected to provide if it is to claim half the benefits according to the provision stipulated in the Mahakali Treaty.[15] Though this investment is about 1.5 times the 1998 budget of Nepal and constitutes a macro-economic risk to the economy, this issue has not been carefully examined.[16]

Another risk associated with reservoir is sedimentation, a corollary phenomenon within the hydrological cycle. Sedimentation has remained a blind spot in the discourse on water-led development in the region, particularly in Nepal.[17] During the monsoon, the Himalayan rivers carry not only

9. The Memorandum of Understanding between HMG/Nepal and Snowy Mountain Engineering Corporation of Australia set the stage for this project.

10. For an elaborate discussion on the politics of cooperative water development, see Gyawali and Dixit (1999).

11. There are two storage sites in the Mahakali basin, seven in the Karnali, seven in the Gandak, five in the Kosi, and nine in other river basins (Gyawali, 1993).

12. R. Rangachari, former member of the Central Water Commission, Government of India, made this observation at a seminar on Eastern Himalayan Rivers held on 3 April 1999 in Kathmandu.

13. Janeswar Mishra, a former water resources minister, Government of India, visited Gorakhpur and remarked, 'Indian government should discuss with its Nepali counterparts about the release of waters from that country into India.' *Agency Reports* (1998).

14. See *The Hindustan Times* (1998). The emphasis on using dams in Nepal to alleviate flooding in the northern Ganga plain is a theme common to all political parties. The Kosi high dam at Barahachetra in Nepal is perceived as a social, economic and hydrological panacea for the state. See Binod Dubey in *The Hindustan Times* 15 February 1999 who quotes Jagdananda Singh, former minister for water resources, Government of Bihar, who said, 'Nothing but the high dam (Kosi) can solve our problem.' Environmental groups in Bihar counter this point of view. They argue that the high dam will bring unmitigated disaster. See *Barh Mukti Abhiyan* (1997).

15. Article 3 of the Treaty states, 'The cost of the project shall be borne by the Parties in proportion to the benefits accruing to them.'

16. See Thapa (1997), and Dhungel (1996).

17. Most of the writings that highlight the potential of water-led development make no mention of the risks posed by sedimentation

water but also solid mass derived from landslide, bank cutting and debris flow-phenomenon that have geological rather than anthropomorphic roots. The suspended sediment is only a fraction of the entire mass of solid matter that flows in rivers. The total load consists of a large percentage of bed load, but this contribution is not accounted for in sediment budgeting. Sedimentation is a natural reality that cannot be totally overcome, but within which interventions have to be negotiated.

The Kulekhani reservoir lost its dead storage capacity just 13 years after impoundment began even though it was expected to have a 100 year life span. The debris flow into the reservoir triggered by the 1993 cloudburst filled a large percentage of its dead storage. In less than 24 hours, the Kulekhani catchment received 540 mm of rainfall and the reservoir level rose by 20 meters in nine hours. In the same period 4.8 million cubic meters of sediment was deposited in the reservoir.[18] In the design the sedimentation rate was assumed to be 88,200 cubic meters.[19] The design of projects grossly underestimate sedimentation rates.

Constructing reservoirs will permanently submerge villages, agricultural land in the hills and displace lakhs of people in Nepal. Because people will be displaced, this endeavour should raise questions about equity. Unfortunately, displacement as an issue has never been seriously considered in the bilateral cooperative initiative on water development.[20] In the discourse on water-led development in Nepal, the social cost of intervention first began to be written about only in 1989. Nepal also lacks expertise in handling the complexities of rehabilitating large populations[21] and implementing environmental mitigation. The country's capability to rehabilitate flood victims is equally limited. Land is scarce in Nepal and its Tarai has been an obvious site for resettlement, which can only take place at the cost of forest cover. In any case, the Tarai which occupies 17% of the country's area already accommodates 50% of the population. Such a resettlement pattern cannot continue indefinitely into the future and alternative innovative solutions will have to be sought to deal with the problem of rehabilitating flood victims.

A major issue is the actual response to flood mitigation, which conventionally is perceived to be the responsibility of governments. There are separate agencies to work on different aspects of floods, ranging from hydrology to relief and rehabilitation, but they are ineffective. There is a conspicuous absence of flood disaster management plans. Even multi-sectoral approaches ensure little coordination and thereby have limited value in mitigating hardships caused by flooding.

The experience so far clearly indicates that in the absence of a comprehensive flood management response, the hardship caused by floods has increased. An important component of any flood management plan is to forecast flood events and to establish appropriate response mechanisms. Flood warning systems are meant to warn potential victims about a flood event and give them sufficient time to take precautionary measures. In the Himalaya-Ganga region the beneficiaries of a flood forecasting mechanism would be the thousands of common people living in the flood plains, along riverbanks and in isolated communities which face drought and floods on a seasonal basis. Misplaced forecasting, however, may result in thousands of people moving away from homes, and without any support from the state agencies face immense hardship, as shown by the Tso Rolpa case in Nepal.[22]

The majority of the flood-affected community lives along marginalised rivers (generally the third grade rivers). The number of people affected by the flooding of these rivers is cumulatively more than the numbers affected by the flooding of the region's major rivers. The condition of the communities living on the banks of and/or affected by floods in these rivers, however, is outside the ambit of the attention of the South Asian states and their administrations.

A number of initiatives in installing flood-forecasting arrangements have been made in the region.[23] In Bangladesh, an updated version of the MIKE 11-FF module developed by the Danish Hydraulic Institute is being used in the Yamuna river. The Central Water Commission in India, which maintains 157 stations throughout the country, is entrusted with the

in the Himalayan rivers. The mainstream discourse in South Asia does not acknowledge sedimentation as a risk. A document jointly prepared by IIDS, CPR and BUP in 1999 argues that soil erosion, landslide and mass movements can be significantly controlled through proper watershed management. A growing volume of scientific literature, however, points to the geologic nature of the sedimentation process in the Himalaya and suggests that watershed management is relevant at the micro level but does not affect annual sediment yield on a regional and river basin scale. See Carson (1980), Ives and Messerli (1995), and Bruninjzeel and Bremmer (1989); also CSE (1991).

18. Nippon Koei (1996).

19. The World Bank (1975).

20. The first account of involuntary displacement appeared in 1988. See Pokharel (1988) and Gurung (1989).

21. For a discussion of the challenges of water project-related dislocation in Nepal, see Dixit (1994).

22. *Ibid*; Gyawali and Dixit (1998).

23. See IIDS/BUP/CPR (1999).

responsibility of forecasting flood. About 80 stations are located on the Ganga and its tributaries.[24]

Nepal and India have an agreement to share real-time rainfall and river water level data. It was expected that from 1992, 20 hydrometric (water level) and 25 regular rainfall stations spread from Kankai Mai in the east to Karnali river in west Nepal would exchange data. The stations are operated and maintained by the Department of Hydrology and Meteorology (DHM) whose personnel collect data twice a day. The data is first transmitted to Kathmandu using a wireless communication facility and then on to the office of the Chief Engineer, Water Resources Commission, in Patna.

Though researchers working in the field of flood mitigation have studied flood-warning systems, the contribution these arrangements made to preparedness planning and minimizing hardship is not yet documented. These earlier studies provide lessons about barriers to the effectiveness of flood warning and about the key relationships that determine failure or success.[25] It is not enough to be able forecast floods. The more important factor that determines flood warning effectiveness is the level of emergency preparedness planning, without which the potential beneficial impacts of flood warning systems remain unrealized. The key is local emergency response and arrangements for providing post flood support to the affected population.

The content of the warning message, the credibility of the message giver, an effective dissemination system, public participation, and the interrelationships among these factors collectively determine flood warning lead-time, which is the practical limit to an effective response. The effectiveness of forecasting also depends on the development of a database and the institutional capacity for its analysis, publication and dissemination. Forecasting needs systematic and long-term monitoring of natural events if our understanding of floods is to improve. It also demands that data must be available whenever it is needed and to whoever needs it. Establishing primary data collection stations (gauging stations, rainfall collecting stations, weather satellite information and so on) lie at the core of our efforts to improve understanding.

Another question relates to the event which is to be forecasted. Approaches to warning differ depending upon what event is expected – a frontal movement, rainfall or a flood. Establishing warning stations involves no major technical difficulties though sufficient financial allocations must be made. Even if finances are made available, there are formidable institutional challenges. One challenge is the international borders between Nepal and India, and Bangladesh and India. The administrative boundaries between the Indian states of Uttar Pradesh, Bihar and West Bengal also introduce difficulties. This is particularly so with respect to different approaches to flood hazard warning and administration of flood mitigation within each state.

Forecasting and warning are easier said than done. A brief recapitulation of our experience between June and August 1998 provides an indication of the challenge involved. To operate a rain gauge was not easy given the difficulty in recruiting a local individual to monitor rainfall. Lack of telephone facilities close to the stations hampered quick transmission of information.

We did get in touch with a network of NGOs in Gorakhpur in order to inform them about the extent of high rainfall experienced in the upper regions and about possible flooding in the lower reaches. The information transmission loop from Nepal's Tarai to Kathmandu and then to Gorakhpur and the villages was shorter than that from Kathmandu to Lucknow and Gorakhpur, but still too long. Information about daily rainfall could not be provided to the flood-affected villages physically cut off from the administrative centres. Simpler and more practical methods need to be devised, and installed, if constraints to warning systems are to be overcome.

Even if a procedure for transmitting information about high rainfall, water levels and possible flood events is established, fundamental questions remain. How would a farmer in the Nepal Tarai or eastern Uttar Pradesh, Bihar, or in Bangladesh take advantage of the message to make his living secure during and after the flooding his village? What can governments, administrators, professionals and members of the civic body do to help minimize the hardship of the people? It is easy to prepare a shopping list of what ought to be done and by whom. The core of the challenge lie on how one goes about implementing what needs to be implemented for an effective response.

Given hydrological asymmetry floods are a reality of the South Asian physical environment. What exacerbates vulnerability is not the natural risk of floods, which is always present, but institutional failure. Institutions are conceived to include rules, regulations, practices, laws and organizations, both formal and informal. Marginal community groups which are unable to cope with a flood face immense suffering. Outbreaks of epi-

24. Chitkara and Mukhopadhyaya (1999).
25. Bari (1996).

demics, which often follow floods, makes the situation worse. The resulting social trauma makes the distress difficult to remedy.

The dominant response to flood mitigation has been hierarchic and guided by the incentive to control. This has meant that efforts to mitigate flood disaster are sought in structural solutions like embankments and/or multipurpose high dams. The structural approach, however, has not been effective. Embankments have greatly exacerbated flood hazards and none of the completed multipurpose projects have been provided with a cushion for accommodating flood flow, despite popular posturing about their flood mitigation benefits. Rarely is it appreciated that the appropriate response to flooding lies in providing unhindered drainage, probably because of the politico-economic incentives of embankment, canal and dam building.

A major constraint is associated with the dissemination of information and facts. Because of its role in shaping public perception, the role of the media is central. In the absence of readily available information about the causes of floods, the media tends to highlight negative attributes and build up hype even if the scientific foundation is shaky. The local media in Uttar Pradesh and Bihar went to the extent of blaming the 1998 deluge to the opening of dam gates, though only the Kulekhani dam has been built in the upstream region. Statements by political leaders are swayed by such hype. Such a response, however, is not uncommon in the region's politics of floods.

The statements also point to two contradictions on how the 'science of floods' is conceived in the mainstream politics of South Asia. The first lesson is that politicians rarely look inward and tend to seek external solutions. Following the flood of 1987, the government of Bihar argued that 'until the time big dams come up in the Nepal Himalaya, we will be forced to stick to embankment construction as a measure of flood control.' Possibly playing the external factor in dealing with flood mitigation in the plains permits a mellowing of dissent arising out of failures on the institutional front.[26] Transferring blame by the propagation of simplified myths is not uncommon in the region's environmental politics.[27]

The 'theory of Himalayan degradation' of the 1970s, for example, attributed lowland flooding to the cutting of trees by hill farmers.' Despite findings which indicate otherwise, this conceptual lacuna is pervasive. The second lesson is that dams are perceived and projected as the solution for mitigating flooding despite the fact that the majority of the dams so far built do not have storage for flood cushioning. The notions couched in the statements of politicians and in media reports are manifestations of a mindset that needs to be changed before better approach to mitigating the impacts of flooding can be adopted.

For the contiguous region along the marginalised rivers that flow from Nepal to eastern and central Uttar Pradesh, Bihar and West Bengal, the events in Rohini provide far-reaching lessons. The region will continue to experience similar rainfall events, albeit with varying magnitude, in the future. The floods are an outcome of intense monsoon frequented by cloudburst, which cannot be predicted. The dams proposed to be constructed on the Nepali rivers to provide flood cushioning such as Panchesawar on the Mahakali, Chisapani on the Karnali, Kosi high dam at Barahchetra, Bagmati, Kamala (Chisapani) and Kankai, even if flood cushion space is optimised, will not reduce flood in the regions along these marginalised rivers which remain vulnerable to flooding from the rains on the unprotected section of the catchment. There is no site on the rivers on which a high dam can be built to provide the necessary flood cushion.

Though 'scientific' evidence about the cause-effect relationship of local flooding is anecdotal, it points to the high uncertainty associated with the hydro-meteorological process and to the fact that extrapolation of rainfall and flow event glosses over local extremes. It is the local extreme which contributes to excessive overland flows and flooding. Haphazard interventions in the flood plains complicate the problem by drainage congestion. The ecological and physical interconnectedness of the region calls for improved collaboration between countries even though, at its root, flood management is a national endeavour. Studying the monsoon, determining its dynamics as it shapes the extent of rainfall events, and translating the results of the studies and making them available to local communities and farmers in a language that they understand are other key areas.

Floods result from a combination of complex factors which are components of a common hydrological matrix. To improve the quality of the state's response to floods, South Asian nations must create scientific infrastructure for day-to-day monitoring and analysis. For improving flood forecasting we must add to the number of rainfall and flow monitoring stations. The existing hydrological stations provide data of varying reliability for only a few rivers and are highly inadequate. The establishment of a sound

26. Ibid. CSE (1991).
27. Chapman (1995).

mechanism for data collection, analysis and interpretation should be intertwined with the establishment of a system of flood forecasting.

The problem is not one of drought or floods, but of risks which the marginal farmers and the poor face at the micro scale. While relief and rehabilitation are crucial from the point of view of supporting the communities hit by floods, equally important are provisions such as risk and life insurance and, in the case of agriculture, crop failure and livestock insurance.[28] Such provisions need to be part of regular governmental functioning. The institutional capability to respond to floods whenever and wherever they occur must be strengthened. The most important condition is that the response to flooding must become, as in development planning, a part of the daily operation, rather than *post-facto* relief.

The governments need to focus on creating a system of regulations, reviews and inspections, on the creation of buffer stock to meet needs in case of flooding in isolated pockets, and on monitoring. Strengthening local bodies through political and legal empowerment will improve impartial regulatory functions such as formulating rules, policies and mechanisms for adjudication. The voluntary sector, as the intermediary between the state and the community, should have a more active role in the mitigation of the impact of floods. We need to reconceptualize our responses in order to meet the challenge of adapting to floods in their entirety. New methods and tools will have to be devised and internalized in the normal operation of our societal and governmental organizations. We also need to create a built-in system of checks and balances, allow space for lateral thinking, and provide society with the pluralism in innovation, caution and regulation it needs in order to bring about stable transition in the management of the risks due to flooding.

28. Ibid. Chapman (1995) who terms such approaches flexible, which the farmers have done for millennia but with an added institutional layer, meaning that the response is local but plugged into the national and regional framework.

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An increasing menace

ASHOK SWAIN

Bangladesh is a country which virtually floats. The greater part of this country comprises a delta laid down by three major rivers – the Ganges, Brahmaputra and Meghna – as they flow down from the Himalaya to the Bay of Bengal. These three rivers do not discharge directly into the sea. Instead, the combined flow of the three passes through the lower Meghna into the Bay. The source of all these rivers lie outside the country. They constitute a combined catchment area of about 1.5 million square kilometres, of which only about 7% lie within the country.

These rivers have greatly contributed to the shaping of the landforms, topography and cultural pattern of Bangladesh. As an annual ritual, from July to September, these mighty rivers break their banks, flooding anything upto two-thirds of the total land area, leaving behind rich alluvial deposits in their wake. Nearly 2.4 billion tons of rich sediment reaches Bangladesh every year through these river systems.

The Ganges river normally has its lowest water level in April. Then, with the melting of the snow in the Himalaya, the water level begins to rise. It usually remains above the danger level during July to September attaining a peak sometimes between mid-August and mid-September. The Brahmaputra river gets its lowest run-off period in February after which it begins to rise and reaches the flood peak by mid-June. Between mid-June and end of September the river flow may rise and fall several times, but the highest flood usually occurs at the end of July or early August.

The Meghna is a much smaller river compared to the other two. It usually reaches its lowest level in February and rises slowly upto May. With a sharp rise from June, Meghna attains peak levels in July, August and September like the other two rivers. Nearly 85% of these three rivers' annual flow comes in the monsoon season, i.e., from June to September. Thus, flood has become an annual visitor to Bangladesh. But, whenever it becomes extensive, it has been due to the rise of water levels in these three major rivers simultaneously.

Bangladesh is primarily dependent on the traditional form of agriculture. The annual deposits of silt carried by the rivers provide a regular input to soil fertility. The freshwater fisheries is also an important aspect of the country's economy. Annual flooding promotes fish productivity and migration. Thus, both the important economic sectors in Bangladesh need normal annual inundation. Bangladesh is one of the world's most fertile countries because of its annual river floods. But, when the flooding becomes severe, it can be catastrophic. It causes loss of life, property, crops and livestock, disrupts rail and road communication. Unfortunately, the number of high and extensive floods have increased in Bangladesh and it now experiences catastrophic floods at least four times in a decade.

Bangladesh experienced a disastrous flooding in 1988. This flood brought three-fourths of Bangladesh

under water, more than 3000 people died and almost 45 million were temporarily displaced. President Ershad of Bangladesh described the flood as 'a catastrophe of an unprecedented dimension' and 'a man-made curse' when he appealed for international assistance. He refused to accept any assistance from India whom he did not hesitate to describe as the main culprit for the misery. Bangladesh even turned back Indian helicopters sent to help flood victims. Bangladeshi authorities and the press blamed the Farakka barrage and other upstream dams in the Ganges river for their misery. However, the worst flood in living memory came in 1998. It broke all past records of flood in terms of duration. This time, though Farakka has not been the target of criticism from the Sheikh Hasina government, the Bangladeshi press has not spared it.

It is true that the upstream diversion of the Ganges river on the Indian side has affected the character of the river in Bangladesh. When water, but no sediment, is diverted at an upstream point, the downstream goes through severe morphological imbalances. The ensuing siltation of the river bed leads to a shifting of the channel. Each river has its own capacity to carry silt; when rivers have to carry additional loads of silt or water in the monsoon season, they start eroding the banks. Shifting is a natural process in an alluvial river. However, man-made changes, such as an upstream withdrawal, can have aggravating effects on bankline movement in the downstream areas. These problems have been observed in the Ganges.

The excessive river bed siltation also contributes to a reduction in the conveyance capacities of river channels in Bangladesh. The discharge data of the Ganges from 1956 to 1990 at Hardinge bridge indicates that the average peak discharge increased by about 12.47% and the average annual low flow decreased by about 61.51%. This major change in the discharge regime of the Ganges may be attributed to the operation of Farakka barrage.

Though India diverts a major share of water in the dry season, it never hesitates in siphoning off the unwanted monsoon flood discharge at Farakka. While in the dry seasons, the Farakka barrage barely leaves a few thousand cusecs of water for Bangladesh, in the monsoon its built-in capacity for flood discharge is up to 2.7 million cusecs. The sudden surge of water to the heavily silted river system substantially contributes to the rising number of high floods in Bangladesh. Moreover, as an allied works to Farakka barrage, India has constructed another barrage with a cross-regulator across the Bhagirathi-Hooghly river at Jangipur above the outfall of the feeder canal. This prevents the flood water over the Farakka barrage from flowing into the Bhagirathi-Hooghly river system.

There is no doubt that the upstream water projects in India, particularly on the Ganges, have added some severity to the floods in Bangladesh. India and Bangladesh signed a 30 years agreement in December 1996 to share the dry season flow of the Ganges at Farakka. However, the treaty does not cover the distribution of the flood water. India is also not eager to provide the river flow data, which Bangladesh needs for early warning purposes to face the flood situation. Bangladesh is in no position to reasonably control its rivers unilaterally since 93% of their catchment areas lie outside the country.

The 1988 flood not only gave the unpopular Ershad regime an opportunity to engage in India bashing, it also brought Bangladesh to the attention of aid donors. France, in an attempt to gain some influence in the developing world outside French-speaking West Africa took the lead. With active support from President Mitterrand's wife Danielle, the French took high level interest in finding a solution to the flooding in Bangladesh. The French government appointed a team of 30 engineers to find a permanent solution to the flood problem, in addition to experts from the USA, Japan and the United Nations Development Programme (UNDP).

The French team proposed a structural solution involving building high embankments along both sides of three major rivers. These river walls were to average 4.5 metres to 7.4 metres in height and from 3000 to 4000 kilometres of length. The estimated cost for this project was nearly $10 billion. The UNDP study echoed the French recommendation but with a lower price tag at $4 billion. However, the US and Japanese studies were skeptical about a complete structural solution. The USAID sponsored Eastern Waters Study recommended 'improvement in the techniques of flood forecasting' and promoted various indigenous ways of 'living with floods'. The Bangladeshi government, as expected, welcomed the French proposal while denouncing the US study of having a 'defeatist tone'.

After reviewing the four proposals, the G-7 countries in their 1989 Summit at Paris asked the World Bank to coordinate the efforts of the international community to address the flood problem in Bangladesh. After getting the mandate, the World Bank came up with a Flood Action Plan for Bangladesh at the end of 1989. This multi-million dollar plan was presented and endorsed at a World Bank conference in London, which tried to incorporate some sections of each of

the four reports, but adopted the structural position propounded by the French. The new scheme called for the construction of hundreds of kilometers of tall embankments along the Ganges and Brahmaputra, and enormous drains to prevent water accumulation on the land behind the levees from local rainfall and tributary rivers. This implied that a huge area of the countryside would be divided into embanked 'compartments' in which controlled flooding would be managed by intakes from rivers and outlets through the drains.

The FAP asked for substantial investment from 11 donor countries and four multilateral agencies, beginning with a $150 million study phase from 1990 to 1995. This study plan comprised 11 main components and 15 supporting studies. The FAP study tried to focus on the identification, planning and construction of feasible high priority projects. Beside the study, FAP also undertook some pilot schemes for which construction costs were estimated at $400 to 500 million. With these studies and pilot schemes, FAP aimed at building high embankments along both sides of Bangladesh's three main rivers.

The initial estimates for the entire FAP project put the figures between 5 to $10 billion, which would make the FAP the biggest development project ever undertaken in Bangladesh. In addition to the numerous studies undertaken, construction work started in some project areas in the early 1990s. The plan consists of a strategy for development of regional water management systems through A.D. 2015, and includes a portfolio of 45 structural and non-structural projects for public and private implementation. Under Phase II, feasibility studies and pilot implementations are being undertaken for several of the projects.

A social movement took shape in Bangladesh around the FAP. The civil society had organized and undertaken a massive awareness and action movement involving all sections of society around the issue of flood control. The result was the formation of a National Water Plan and a commitment to integrate people's participation and environmental concerns in the plan. However, implementation of FAP has not moved very far after the completion of the Phase I, mainly because of conflicts of interest between and within the bureaucracy and politicians.

Though the donors, both bilateral and multilateral, have become far more sensitive about how their money was to be spent, largely due to the criticism and campaigns by local and international NGOs, the 1998 flood once again brought the country back to the donors' concern. The present government of Bangladesh has also shown its preference for a structural solution. After the 1998 flood, the Hasina government quickly declared its intention to build a 50 mile embankment around Dhaka.

Implementation of this mega project is unlikely to solve the flooding problem. Instead it may create a series of geologic, hydrologic, economic, environmental, agricultural, ecological and social problems. Bangladesh's experience with flood control structures are a strong argument against building more of them. Before 1990, Bangladesh had already constructed about 7500 kilometres of embankment and 8000 water control structures. Even with more than 200 flood control, drainage and irrigation projects, Bangladesh has failed to protect its agricultural land from river flood. Further and foolproof flood preventive measures are of doubtful validity, considering the nature of channel migration of the major rivers. The Brahmaputra river has shifted eight kilometres at Serajganj in the last 70 years. Rivers are not only shifting the course of their channels, their width has also gradually increased in some areas.

In spite of a major increase in flood protected areas in the 1970s and 1980s, an increase in *aman* (rice crop sown in monsoon and harvested after monsoon) rice production in Bangladesh from 1973 to 1987 has not been significant. In some areas, where flood control measures have been already undertaken, rice production has started declining after showing some initial increase. Though these flood structures were heavily damaged by the floods of 1987 and 1988, aman rice production was significantly higher in Bangladesh in 1989 and 1990. This may happen in 1999 too.

The large embankments may pose a serious threat to capture fisheries in Bangladesh. Fish happens to be the major source of protein for the average citizen. Most of the country's freshwater fish grow in the shallow open waters. If wetlands becomes dry due to flood control measures, nearly 800,000 fisherfolk will loose part, or all, of their livelihoods. It is near impossible to compensate the loss of capture fisheries through culture fisheries. The 'higher economic returns' from culture fisheries will of course benefit the rich while further impoverishing the poor.

To control floods, structural measures adopt a policy of creating compartmentalised sections in the flood prone areas. The gradual silting up of the inlets and outlets of these compartments leads to water logging. The concept of controlled flooding is dependent on the technical performance as well as the coordinated operations of the water regulating structures.

In the absence of an effective conflict management mechanism, there will be serious disagreement over when and how much to flood the compartment areas.

The large-scale river embankment projects also threaten people living on unstable alluvial islands (*chars*) in the main rivers. There is concern that such people might suffer from increased flood levels and channel instability if new embankments confine the main channel. It is impossible to resettle such people elsewhere. There is nowhere for them to go in this highly populated country.

Bangladesh has always blamed the Farakka barrage for its contribution to the worsening flood situation downstream. But, for a long time, Bangladesh herself has seriously considered building another barrage on its own territory. In the name of irrigation and flood control, the present government has given top priority to the construction of a barrage over the Ganges between the Gorai and the Ganges-Brahmaputra confluence. The current estimated cost for the construction of this barrage is over $1.5 billion. The signing of the 1996 Ganges Sharing Treaty has paved the way for the involvement of the World Bank, Asian Development Bank and other funding agencies. The Bangladesh elite has drawn enormous advantages from the construction of huge projects. Unfortunately, they have become vast income generating schemes for commission seeking bureaucrats, politicians and rich contractors.

Whether through FAP or any other structural scheme, total control or elimination of floods in Bangladesh is neither feasible nor desirable. Even the USA with its structural measures has not been able to tame the Mississippi river system. The massive flood in 1993 in the Mississippi delta exposed the weaknesses of the structural solution. Thus, some argue, Bangladesh does not need a flood prevention policy; rather it should work for flood adaptation. A number of alternatives which exist between the extremes can be explored to maximise the benefits of the flood and minimise its losses. Bangladeshis have undertaken a number of adaptive actions to meet the flood hazard. Adjustments in agriculture, particularly the adaptation of different types of crops to varied flood depths, is one. Proper early warning systems, floodplain zoning and support to indigenous techniques of survival should also be encouraged.

People's participation and support are required, starting from the planning stage and continuing through the life of a water management project. A number of flood control measures in the past were undermined by farmers who frequently cut embankments to release flood water from their land. A problem with most government schemes is that they are hurriedly prepared after major floods and, in their initial stages, fail to involve the people. For flood management projects to be successful it is essential to ensure people's participation. Public involvement and community organization should not be ignored when attention is paid to institutional interests.

In designing flood management strategies, attention should also be given to social capital. A poor country like Bangladesh cannot address its flood problem only with the help of physical capital. The existing social capital in society helps flood affected communities to prepare for and respond to the flooding. Traditionally, floods have also been a major source for generating social capital, i.e., trust and networks within Bangladeshi society.

A fear of flood creates closer ties in the traditional *samaj* organisations. These informal organisations are based on the social and religious interests of its members. Samaj provides a forum for frequent interaction due to social and ceremonial occasions. During floods, members of the samaj are obliged to help each other. Traditionally, Bangladeshis have organised through the samaj and survived within the physical constraints. Research studies have clearly demonstrated that households who belong to the samaj were better prepared to cope with hazards than those who were out of the samaj. Thus, measures to develop such social networks must be encouraged.

Social capital reflecting caring, goodwill, sense of belonging, sense of community, or social closeness and loyalty can contribute greatly to the success of a government's flood management effort. Unfortunately, the strategies adopted by the government, such as providing voluminous, extraneous information on flood management, asserting ignorance of the flood situation and its causes, emphasising past accomplishments of flood control measures, manipulating river flow data, and discouraging public discussion, are a sure recipe for hindering and undoing the formation of social capital among citizens.

Instead, state elites need to change their attitude and create an enabling environment which would protect the existing social capital and take measures to make use of social capital in local-level institutions, and invest in institutions that have or can create social capital. Without appropriate social strength, Bangladesh will not succeed in overcoming the menace of floods. Structural measures for flood management need to be adequately backed by social measures.

Governance and floods

IMTIAZ AHMED

GOVERNMENT was never an all-encompassing entity in this part of the world. During the 300-years of Mughal rule and even before, the 'government', as it was understood then, busied itself in collecting revenues and all the 'good things' in the society mainly for the consumption and enrichment of the sovereign and his/her close associates. The relationship between the sovereign and the people was essentially *linear* with the latter providing all the 'wealth' and, at times, also 'wisdom' to the sovereign. The sovereign, for its part, did not bother much with the life and lifestyle of the people. Things began to change, however, with the coming of the British and the colonization of South Asia.

Colonialism in South Asia went through two phases. In the first phase (from 1757 to the end of the 18th century), the colonial power, given its youthful position, settled for a conciliatory gesture towards the traditional elite. During this phase, the colonial power even promoted indigenous education, establishing the Calcutta Alia Madrasa and the Benares Sanskrit College in 1781 and 1792 respectively. While there was an element of genuine interest among some British officials in propagating India's culture and languages, the policy itself was no less related to the colonial need for a

class of native officials well versed in Persian, Arabic or Sanskrit so that the latter could assist them in governing the country.[1] With the maturity of British domination, however, such a need gave way to a newer dimension in the organization of governance.

The second phase of colonialism, understood more as 'colonialism proper'[2] (a synonym for intellectual dependency of the South Asians on the West), began (to be precise) in 1835, with the introduction of English as a medium of instruction. Thomas Macaulay and his education policy were instrumental in organizing and reproducing this phase. As president of the General Committee of Public Instruction, Macaulay declared that the British education policy in India was designed to create 'a clan who would be interpreters between us and the millions whom we *govern*, a class of persons Indian in blood and colour, but *English in tastes, in opinions, in morals and intellect* (emphasis added).'[3] Consequently, in less than a hundred years or so, the task of the government, including the nature of governance, was radically transformed, with critical long-term consequences.

In fact, as early as 1926, Nirad C. Chaudhuri, with his usual flare for sarcasm, gave us a unique account of what 'colonialism proper' had done to the Bengali mind, notwithstanding the fact that such colonized minds had otherwise been active in the nationalist struggle against the British: '[The] real cultural role of the Bengalis...is to assimilate, by slow degrees, the ways of Europe, till at last, civilisation in India becomes the provincial edition of the civilisation of Europe, palely reflecting like the moon, its borrowed light from the great sun beyond. In political, economic and scientific thought, there is not and indeed cannot be any question of a distinctly national stamp. The sterility of political and economic thought is particularly striking.... It is the same with economic organisation.... It is so in every branch of intellectual activity.'[4]

In the wake of 'colonialism proper', with the government *surveilling* and *controlling* the task of knowledge production and diffusion, the relationship between the government and the people got transformed from one of a linearized state of resignation to something that can best be referred to as menacingly governmental.

The Pakistani phase of semi colonialism further *governmentalized* things and ideas in Bangladesh, indeed, to a point where guarding the national flag, building a highway, designing curricula for schools, providing relief to the people, even collecting household garbage – all became the responsibility of the government. Indeed, governmental *policy*, whatever may have been its target and field of operations increasingly came to be viewed as ways and means of *policing* the people.

Resistance at that time was built on the belief that if the semi-colonial (Pakistani) government were removed, the government of free Bangladesh would be able to deliver things. In the process, however, neither the practice of rendering governmental policy (the cause of the contention) nor the culture of policing the people (the cause of the action) got removed. Bangladesh, for that matter, remained highly governmentalized since its very inception in 1971.

It is against this background that the issue of flood management and/or post-flood relief, rehabilitation and rebuilding activities will be treated. In addressing this issue, we will primarily focus on the 1998 deluge in Bangladesh, now recognized as the most devastating flood the country has ever faced in this century. We will limit our discussion to three areas, each of which will highlight the governmentalized nature of things and the limitation it imposes on the task of mitigating problems arising from floods, particularly the ones that are more commonly referred to as *banya* in colloquial Bangla. At the very end of our discussion, we will reflect on the issue of what is to be done.

Few people in this world prefer to live a life by means of relief. And when relief takes place at a community level, the pain is even greater. In the wake of the 1998 flood, I was reminded by a village relief-activist that 'relief demoralizes the community.' This can hardly be disputed in terms of the demands of the affected millions. Many of the affected that I talked to, instead of asking for relief, wanted work and only work. And that again, any kind of work that would somehow sustain their life, if not the pre-flood livelihood they had.

But then, the only way the principle of 'work without relief' can be organized and sustained effectively is by providing the affected with productive work. But this is something the governmental machinery is hardly equipped to accomplish, although the country has an unbroken record of

1. S.K. Agrawala, 'The Universities of India', in *The Universities of Commonwealth Countries*, London, 1994, p. 799. Also, Aparna Basu, 'Policy and Conflict in India: The Reality and Perception of Education', in Philip G. Altbach and Gail P. Kelly (ed.), *Education and Colonialism*, Longman, New York, 1978, p. 54.

2. For a closer exposition, see Ashis Nandy, *The Intimate Enemy: Loss and Recovery of Self under Colonialism*, Oxford University Press, Delhi, 1983.

3. Ct. from S.K. Agrawala, op cit., p. 799.

4. Nirad C. Chaudhuri, *The East is East and The West is West*, Mitra & Ghosh Publishers, Calcutta, 1996, pp. 4-5.

regularly experiencing small and big floods. Instead, with the onslaught of floods, the government quickly takes recourse to *reliefing* the people which, apart from demoralizing the latter, tends to disempower them as well. Let me explain.

To feed the most affected, numbering around 4.6 million people in the aftermath of the 1998 flood, the government, under a revised vulnerable group feeding (VGF) programme, made arrangements to allot each family 16 kg of foodgrain per month. This was done with the understanding that another 16 kg of food would be provided through other sources like food for work, test relief, personal initiatives, and so on. But with 'other sources' remaining mostly ill-timed if not barren, particularly in the worst affected areas, the most affected never got access to the additional 16 kg of food. Was the VGF allotment adequate then? Before taking up this issue, two points need some attention.

The first relates to the government policy of *evenly* distributing the VGF cards across the country. On the surface this may appear democratic, but actually it is geared towards reproducing the power of the government without taking into consideration the actual plight of the most affected. In fact, the even distribution of VGF cards meant that areas that were not hard hit by the flood received the same number of cards as those areas that were actually devastated by the flood. At times, therefore, those who needed the cards least got hold of them, while those who needed them most failed to get even one. In some areas this meant that the most affected remained unwell or under-fed for months. To cite some examples, in Roumari *thana* 18,000 VGF cards were required but only 7,000 were distributed. In Chilmari thana about 17,000 cards were required but only 7,400 cards were distributed.[5] Both these areas were among the most affected. Indeed, in the wake of government's politically constructed even-handedness, many of the flood-affected people continued to suffer.

Second, in so far as the distribution of VGF cards remained a governmental exercise, partisanship in relief distribution could not be avoided. In fact, the government took the distribution of VGF card as something of a party achievement and claimed it as such when there was less chaos or corruption in their distribution, although the success of such distribution could be for reasons not necessarily tied up with governmental efficiency.

Indeed, and somewhat ironically, no less prominent was the role of *polarized politics*, with the opposition parties keeping an all-time vigilance over the relief activities of the government and vice versa. This had greatly ensured the smooth running of the VGF programme at the time of the flood and its aftermath. Governmental (partisan) claims, however, dampened the role of the opposition parties, who lost no time in distancing their own flood programmes from those of the government. In the midst of this senseless competition, many a time the most affected were left on their own![6]

More critical, however, is the actual VGF allotment. This had a damaging consequence from the standpoint of nutrition. Indeed, the 16 kg VGF allotment could provide only 1200 Kcal/day, much below the required 2100 Kcal/day advocated by scholars and aid agencies.[7] Put differently, even with the proper implementation of VGF many of the recipients remained malnourished, if not in a semi-starved condition. The government, however, faced little problem on this matter, for 'malnourishment' is yet to be considered a proper agenda for public protest and struggle.

Interestingly, the success of the government in handling flood is mostly judged by its ability to contain *famine*, which incidentally (following no other person than the Nobel laureate, Amartya Sen) now holds a precise meaning.[8] And that is, unless there is death in thousands, death by hunger cannot be referred to as famine. Put differently, many deaths count, a few do not. Much of this has to do with hunger-related deaths of the 1940s and even of the mid-1970s when people died of hunger in hundreds and thousands (officially 1.5 million and 26,000 respectively, while unofficially 3 million and 1 million respectively).[9]

But death is death, whether it is of a few or many, and if it is *hunger-caused* it should be defined as such and not in terms of numbers. The lat-

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5. Syed M. Hashemi and Imtiaz Ahmed, 'The Post-Flood Period: Still too Early to Celebrate', in Imtiaz Ahmed (ed.), *Living with Floods: An Exercise in Alternatives*, University Press Limited, Dhaka, (forthcoming).

6. There have been several instances when the ruling party (Awami League) and the main opposition party (BNP) provided relief materials to the same locality, for reasons of strengthening their support base. At times, such localities were near Dhaka city so that the politicians could have their photographs taken by television crews or newspaper people and have them projected nationally. In the process, however, other more affected localities were ignored with the people left to their own devices.

7. For details on the minimum calorie requirement in Bangladesh, see Mohiuddin Alamgir, 'Some Analysis of Distribution of Income, Consumption, Saving and Poverty in Bangladesh', *The Bangladesh Development Studies*, Vol. II, No. 4, October 1974.

8. Amartya Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation*, Oxford University Press, Oxford, 1981, p. 40.

9. Ibid., p. 134 and 215.

ter would simply make death hostage to some dehumanized scientific category and free from all kinds of moral nuances and social responsibility. But that is not all.

While widespread death-based famine is an improbability at the fag end of the 20th century, particularly in the light of heightened social awareness, NGO activities, better communication, inter-party vigilance, governmental sensitivity, and so on, *slow-death* or *perennial illness by malnourishment* in greater numbers is not. Without making the post-flood rehabilitation task of 1998 a cause for celebration because thousands did not die and therefore definitionally no famine took place, it is high time, I believe, to focus on the slow-death or the perennially ill and begin a process of reconceptualizing and redefining the very concept of famine. This would go a long way in not only making the profoundly powerful ethical claim that death by hunger, even a single one, is not acceptable but also in making the government sensitive to long-term, life-threatening problems arising from malnourishment. Anything short of this will keep on reproducing a malnourished, low IQ-ed and socially varied people in the country; indeed, with some living a life of a fly while others enjoy flying lives!

A serious concern throughout the flood period was the lack of work for the many of the affected, particularly the able-bodied people. This is indeed an irony, for while there is so much work to do in the affected areas, many of the affected are practically without work for months. At one point of time, there was lack of work in almost all of the affected areas – from Kurigram to Kishoreganj, Comilla to Chapai-Nawabganj, Gaibandha to Gopalganj. And this continued to be so as late as November (that is, 4-5 months after the flood first began), although the extent of the no-work syndrome was greater in the most affected areas that border the banks of the mighty Brahmaputra and Jamuna.

At the time of flood, however, the testimony of having no work on a massive scale, somewhat ironically, lay in the low price of essential goods. The price of rice in Kurigram, for instance, was around Taka 14 per kg, markedly lower than the price of rice in Dhaka or even in Benapole (around Taka 20 and 24 per kg respectively). While in normal circumstances this would have been a cause for celebration for the Kurigramites, it was actually the result of a no-work syndrome or a lack of purchasing power that had prevailed for many months in those areas.

But why is there no work to be found? I guess part of the answer lies in the governmental introduction, albeit under pressure from international donors and the modernist scientific community, of a new cropping pattern in the country, which effectively replaced the age-old method practiced in Bangladesh.

As Nazrul Islam noted: 'The cropping pattern [in Bangladesh] was intricately adjusted to the deltaic conditions. Through a process of natural selection, the people of Bangladesh developed the amazing varieties of *bona aman*, which can grow twenty feet tall or even higher to withstand deep flooding. These miraculous paddy stalks just float in water and can grow up to a foot in twenty-four hours just to keep pace with the fast rising level of flood water. These capabilities of *bona aman* are yet to be matched by anything produced by modern plant breeding. Bangladeshi farmers also developed *ropa aman* to adjust to the brief time period that is usually available between *aus* harvest and arrival of floodwater.'[10]

With the introduction of high yielding variety (HYV) seeds, flood-centric varieties like bona aman and ropa aman became less attractive and financially rewarding to the farmers. The HYV, given its dependence on fertilizers and controlled irrigation, can hardly survive in the midst of big floods. Since many of the affected, under active governmental support, have abandoned the former cropping pattern for the latter, it is not surprising that they are without work and consequently with meagre purchasing power once a flood happens and drowns their HYV crops. In such a situation, they can do one or two of the following things.

First, they can start using their savings. The governmental machinery is absolutely inefficient in this respect, particularly when it comes to the issue of savings of and for the poor. In Bangladesh, this task has been performed with some success by the NGOs. In fact, this is precisely what the major NGOs, including the Grameen Bank, opted for, providing the long-term borrower the full access to her/his past savings. But then again, this has obvious limitations, for the volume of such savings for each individual or household is not that great. Moreover, in so far as the role of NGOs is concerned there is something else that needs to be clarified.

There has been some coverage of NGOs working effortlessly to overcome the damages wrought by the deluge and that again, almost devoid of any organizational interest. This is, however, less true in the post-flood period. In fact, in the post-flood period NGO work has been marked by a precise set of activities limited mostly, if not wholly, to NGO members only.

10. Nazrul Islam, 'Flood Control in Bangladesh: Which Way Now?' in Imtiaz Ahmed, op cit., p. 95.

This has made the non-members, many of whom belonging to the most affected category, doubly vulnerable, as NGO activities by treating them as functionally invisible make their plight appear less alarming. Even the government or private donors lose sight of them, as there is none to rally for them.

Second, they could take up distress selling. A nationwide field survey in 15,467 villages carried out by members of Nagarik Durjog Mokabila Udyog (a civil response body formed during the flood), found that the incidence of distress selling was considerably high at the time of the flood. The accompanying table is illustrative.

Incidence of Distress Selling

(Percentage of villages)

	Whether Distress Selling Increased Compared to the Normal Period					
	Land		*Domestic Animal*		*Other Assets*	
	Yes	*No*	*Yes*	*No*	*Yes*	*No*
Severe	59.0	41.0	87.1	12.9	73.8	26.2
Moderate	59.8	40.2	87.9	12.1	71.8	28.2
Normal/No Affect	44.2	55.8	73.5	26.5	56.3	43.7

Source: Binayak Sen, Syed M. Hashemi and Imtiaz Ahmed, Impact of Flood on Rural Economy: Results from a Large-Scale Rapid Survey. Paper presented at a national seminar on The Deluge of 1998, organized by the Nagarik Durjog Mokabila Udyog, 31 December 1998.

Since there is no governmental plan to offset such selling, nor are there regulations for receiving a fair price by the distressed seller, a severe flood often comes as a boon to moneylenders and those in a position to buy crops. At such times, the highly governmentalized banking system (both public and private, with the possible exception of the trustee-managed Grameen Bank) accelerates this process by demanding collateral from the affected persons.

Finally, they could migrate. This could be either internal or external. In the month of October, a random survey conducted by a non-governmental organization found that 9% of the village households in the flood-affected areas were totally looked after by women, implying that their husbands had left the villages in search of work.[11] Hossain Zillur Rahman carried out a survey on the floating population of Dhaka and found 20% of them to be recent migrants. Of the in-migrants, 52% indicated 'lack of work', while 8% mentioned 'prevailing hunger situation' as reasons for coming to Dhaka.[12] The survey also found that most of the migrants take up peddling, petty trade, rickshaw pulling and the like once they reach the city. But then, not all of this work comes as a blessing to the migrant or the city; rickshaw pulling, for instance.

Previously, the rickshaw industry in Dhaka enjoyed a steady 'horizontal' growth, with the city mismanaged by some 3.8 lakh rickshaw pullers, though only 80,000 of the rickshaws had valid licenses. Thanks to the post-flood (no work in the village) syndrome, the horizontal growth has been supplemented by a 'vertical' growth of the rickshaw industry in Dhaka city. This refers to the subletting of rickshaws by fellow rickshaw pullers, which at times could be for a duration as short as two hours. The ill-effect of this growth can hardly be exaggerated. Not only does it help in reproducing a culturally sloth *bhadralok* (using a rickshaw where they can easily walk), it also tends to overburden the city and waste the creative energy of the pullers. But this is only one side of the migration.

This time with unprecedented floods in both Bangladesh and India (particularly in West Bengal and Assam), migration (I believe) criss-crossed both ways. Given the prompt availability of international relief in Bangladesh, one should not be surprised if some distressed people from Malda and Murshidabad, the two hardest-hit areas of West Bengal, were found crossing over to Bangladesh. And the case no doubt was the opposite where relief failed to reach the flood-affected border areas of Bangladesh in a timely and substantial fashion. This is indeed a regional issue and ought to be resolved regionally. The point to be emphasized is that flood itself is a regional issue and the construction of numerous dams in both West Bengal and the North East is no less responsible for contributing to the severity of the deluge in this region. The resolution, therefore, lies in tackling the issue regionally. This is a far cry from the position of the governments, whether of Bangladesh or India, who are bent on reproducing a self-serving nationalist agenda.

Thanks to the governmental role, or lack of it, disentitlement has effectively displaced many of the affected. In so far as this scenario has less to do with the availability of food and more to do with the need for work and purchasing power, it is high time we rename and refunctionalize the Ministry of Food into the Ministry of Entitlement and Food. This is not to argue that the solution lies in reforming or

11. Oxfam, Dhaka, conducted the survey.

12. Hossain Zillur Rahman, Early Warning on Post-Flood Coping: Findings on In-Migration to Dhaka. Paper presented at a national seminar on The Deluge of 1998, organized by Nagarik Durjog Mokabila Udyog, 31 December 1998.

restructuring governmental intervention only. More on this later.

Critics have lately suggested that there is a 'strong human component' affecting both the extent of destruction and the number of people killed or displaced in natural calamities. It is not a simple case of divine wrath about which little can be done but, in the light of the human component, is more a case where the natural can be rectified. The task, however, is not a simple one and, in so far as both 'nature' and 'humans' have conjointly produced natural disasters in modern times, including the severity of the 1998 deluge, there is no scope for wholly naturalizing or de-humanizing the event/process.

The case of controlling (or as the practice indicates, preventing) floods via embankments provides a good instance. Interestingly, this time both friends and foe congratulated the former president, Hussain Muhammad Ershad, for having saved Dhaka. And lest this be made into a vote-catching issue in the future, if for no other reason, the Awami League government quickly declared its intention to build a 50-mile embankment around Dhaka. But how sound is this thinking? Is it not true that the embankment that 'saved' Dhaka also brought unprecedented floods and suffering to the people living on the other side of the embankment? And then again, if Bangladesh consists of villages where millions live, is it possible to embank all the villages? There are other problems as well.

Much of the apathy and the unconcern that we witnessed in Dhaka, particularly at the beginning of the flood and until the DND (Dhaka-Narayanganj-Demra) 'embankment collapsing scare',[13] could indeed have been a result of Ershad's partial embankment of Dhaka. If this is the case, it is worrying that with Dhaka fully embanked and protected there will be even less cause for the government to save the villages and a majority of people from the floods. Indeed, for the sake of protecting the country from destruction of this magnitude, the highly governmentalized flood protection scheme must be abandoned for there is little in it that can bring benefit to those who require the most protection from floods.

Embanking an area or rivers and protecting the population from flood came as a result of foreign involvement, particularly the United States, in the aftermath of the great flood of 1950 and a request by the then government of Pakistan for international support. A commission, headed by none other than a member of the U.S. Army Engineer Corps, recommended the construction of big water development projects, including the DND Project, the Brahmaputra Right Hand Embankment Project, the Ganges-Kobadak Project and so on, for controlling the flood waters.[14] During the Pakistan era (that is until 1971) this did not go far, largely because of the unwillingness on the part of the (semi-colonial) government to commit funds for the betterment of the semi colonized subjects.

The age-old recommendation for controlling floods via embankments, however, got a big boost with the onslaught of yet another big flood in 1987-1988. This time, with the government as an active member and the World Bank as the chief coordinator, international donors (altogether 14) opted for the same old embankment approach, albeit with the addition of a guideline for people's participation, including the recognition of the benefits of normal flooding. Indeed, the Flood Action Plan (or FAP as it is more popularly known) that came into being following the floods of the 1980s included projects aimed at protecting the banks and fixing the riverbed. To name a few, FAP 1 (Brahmaputra Right Embankment Strengthening), FAP 3.1 (Jamalpur Priority Project), FAP 9B (Meghna River Bank Protection Project), FAP 21 (Bank Protection Pilot Project) and FAP 22 (River Training and Active Flood Plain Management Pilot Project).[15] Put differently, it was nothing but old wine in a new bottle.

More importantly, how sound is the embankment approach? A study by K. Stewart of two samples each of 300 households, one inside the Meghna-Donagoda embankment and one outside the embankment and carried out in October-November 1988, found that the average material damage was higher inside the embankment.[16] This is because drainage after the flood is far more rapid on the river-side of the embankment than the side that is embanked and protected. Moreover, the condition of the embanked area becomes more acute when the flood is caused by excessive rainwater. Only a pumped drainage can overcome this problem but then, as Peter Rogers and his team (while conduct-

13. The DND embankment was on the verge of collapse. Thousands of people literally saved the embankment by sandbagging it round the clock for almost a week.

14. For a closer exposition, see Nazrul Islam, op cit.

15. Hanna Schmuck-Widman, *Living with the Floods: Survival Strategies of Char Dwellers in Bangladesh*, FDCL, Berlin, 1996, p. 8 and 96.

16. K. Stewart, Post Flood: Assessment and Nutritional Status of Children in Matlab, Bangladesh. Paper presented in Regional and Global Environmental Perspectives, Dhaka, 4-6 March 1989. Also cited in Peter Rogers, Peter Lydon and David Seckler, *Eastern Waters Study: Strategies to Manage Flood and Drought in the Ganges-Brahmaputra Basin*, ISPAN, Arlington, Virginia, April 1989, p. 52.

ing a study commissioned by USAID) maintained, it is a very expensive undertaking.[17] This team also questioned the short- and long-term benefits of embankment construction in Bangladesh.

Why then is embankment construction vigorously pursued? Nazrul Islam provides a good answer:

'There are powerful material *interests* at work. Big embankment projects are often lucrative to the government because these can bring in large amount of foreign aid. This makes some politicians happy because they can then show the electorate that they are bringing home money. Embankment projects make some bureaucrats happy because they can preside over large spending programmes. Such projects can make consultant, engineering, and construction companies happy because they can all get large contracts. It is easy to extend this list of direct beneficiaries of embankment programme. Add to this the possibility that some of these actors may actually be *corrupt*, and hope to illegally benefit from these projects, and it is easy to understand why passions can run very high....

'Large budget embankment programme suits donor agencies well too. There is little accountability on the part of the donor officials, because they distribute other people's (developed countries' taxpayers') money, and ultimate effectiveness of the project can touch them hardly at all.'[18]

Given the futility of embanking the whole or even part of deltaic Bangladesh, there is good reason to believe that the governmental policy of supporting embankment construction is directed mainly by the prospect of large cash flow for the benefit of some self-seeking individuals rather than controlling floods for the betterment of the lives of the common people. Governmental embankment policy, particularly in the midst of frequent floods and suffering, is nothing but a recipe for violent conflict in the not so distant future.

What is to be done? There is obviously no simple answer. I will, however, stress on two suggestions which are required to change the existing state of affairs.

1. *De-governmentalizing governmental power.* This essentially refers to the task of empowering civil society, with *increased civic response* signaling its empowered position. A word or two, however, is required on the issue of civic response.

Much of what goes under the banner of civic response in Bangladesh is mainly 'individual initiatives'. In fact, one could divide the civic response broadly into 'individual' and 'civic' initiatives, the latter standing for organized, civil or non governmental, group-based initiatives. With my brief experience as a member of Nagarik Durjog Mokabila Udyog, I have no hesitation in admitting that civic initiative in the field of disaster management (and I would imagine in other areas as well) is thoroughly disorganized and bereft of creative input. Even with the Nagarik Durjog Mokabila Udyog, although organized and manned by powerful members of civil society,[19] nothing worthy of record was accomplished. There are good reasons for this. Two could easily be identified.

First, civil society in Bangladesh is highly polarized and this factor readily seeps into every kind of organization, association or institution, whether political or non-political. This implies that members belonging to various non-political or civil organizations operate in a way as not to disturb or become alienated from their respective political affiliations. At times, members are ready to sacrifice even the core purpose of their respective civil organizations in order to meet the ends of their respective political organizations. Such is the fate of civic initiatives in Bangladesh.

But curiously, not everything is depressing. At the time of the flood, the polarized civil society did play out differently in certain areas. There was less deterioration of the law and order situation, for instance. In fact, the survey conducted by Nagarik Durjog Mokabila Udyog, which we have referred to earlier, found that the law and order situation deteriorated in only 13 to 17% of the villages whereas in over 80% of the villages there was no such deterioration.[20] More interestingly, it was found that there was less corruption or irregularities in food/relief distribution, not unwisely, as some suggested, because of the intense rivalry between various political parties, including vigilance on the part of both ruling and opposition parties.[21] One requires tapping the immense possibilities arising from what seemed to be deviations from the norm. But then, one would always require a disaster of one kind or another for deviations to promote good.

Second, a culture of 'donor-fed consultancy' so dominates Bangladesh that a handful of those who could creatively reproduce civil organizations seldom have the time and the patience to invest in this effort. Put dif-

17. Peter Rogers, Peter Lydon and David Seckler, ibid.

18. Nazrul Islam, op cit.

19. For a list of the membership, see Imtiaz Ahmed, op cit.

20. Ibid., Appendix, Table 10.

21. This is based on the author's discussion with a cross-section of people in the flood-affected areas.

ferently, donor-fed consultancy limits its civic participation, particularly of the voluntary type that we have known for centuries in this part of the world. It goes without saying that if some of these otherwise creative 'native consultants' are provided with adequate funds and an opportunity to shape and organize the civic response there will indeed be no lacking of dynamic inputs in the response. In this context, the need for *institutionalizing* civic response, particularly in the field of disaster management, can hardly be exaggerated. The next deluge can then be tackled more efficiently and effectively.

2. *Revitalizing the culture of living with floods*. With big floods occurring every decade, there is an urgent need to reorient our present mode of living into one which is more flood or water-centric. Ajaya Dixit, Ashis Nandy and I tried to highlight this need for reorienting our life and living while working together on A South Asian Manifesto on the Politics and Knowledge of Water. We collectively maintained:

'Till now, the approach to water management and water development has been fragmentary. Not only has it dealt with sea, river and groundwater separately, it has been "land-centric". Water management, we believe, should centre around water; it must be based on the recognition of the wholeness of water and its intrinsic function in nature. A comprehensive view also demands critical interventions in the curricula at all levels of education. The principal challenge is, therefore, to integrate the global and the local, to alter the structure and nature of current decision-making models, and the educational context within which they are generated, not only to accommodate a plurality of views, but also to generate options that would reflect the larger reality of water in nature and human society.'[22]

The range of activities that can be expected from such reorientation is immense. Not only will it provide space for including a more sensible and topographically relevant cropping system, discussed earlier, but also a mode of settlement based on the long-lost principle of 'dig-elevate-dwell'. The latter refers to a practice in Bengal going back over thousands of years where people in order to construct houses first dug ditches and then used the excavated earth to elevate the land. Houses were then constructed on this elevated land.[23] In the process, they also succeeded in making new ponds and dredging silted canals, particularly during the dry season, which must have worked to their benefit at the time of flood. It is high time that we make use of this age-old wisdom, albeit with proper innovations, to meet the current state of living.

The reorientation will also allow us to reinvent and rebuild the much-required water-based communication systems, flood-free housing structures, flood-time schooling, and much more. Only a timely investment on the culture of *living with floods* will allow us to transform the current curse that so frequently accompanies the floods and thereby make our life more livable in the midst of the not-so-natural floods. Since the government, as currently constituted, is ill-equipped to undertake such an investment, the onus of carrying out this immense task lies with all those concerned and the affected millions. And therein lies our hope.

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22. Imtiaz Ahmed, Ajaya Dixit and Ashis Nandy, *Water, Power and People: A South Asian Manifesto on the Politics and Knowledge of Water*, Regional Centre for Strategic Studies, Colombo, 1997, pp. 10-11.

23. For a closer exposition, see Nazrul Islam, op cit.

Drowning people, killing hope

DUNU ROY

Rajendra, farmer from Bangladesh: 'Such water, what the Lord has given us!' (1997)

Nivedita, missionary from England: 'Hunger so keen, ah God! so keen!' (1907)

TWO statements, made almost a hundred years apart, illustrate the dual nature of floods. A sheet of moving water covering vast areas of land can be both a blessing as well as a disaster. How best can we understand this phenomenon of floods? What is it about floods that so torments public consciousness?

At the beginning of this century, in 1906, Sister Nivedita evocatively described a tragedy beyond imagining. At one stage she recounts what a doctor working in the flooded areas of Backergunge (now in Bangladesh) told her. 'I had never thought,' said the young doctor, 'to see such scenes... three or four women with children had been deserted by their husbands. One of these had heard of government loans to agriculturists and had gone out to apply for one. He was refused at Nazirpore by the deputy magistrate, and refused at Pirozepore by a higher official. So he brought no rice. But he was absent from the village for three whole days, and in his absence there had been no food at home. He returned and found the whole family unconscious.'

The harrowing tales that the good Sister heard and wrote about were shocking for that time and age, but 90 years later they appear to describe the normal conditions of life for an unconscionable number of our people. For instance, Rajasthan – a supposedly dry region on the other side

of the subcontinent from Bengal – had unusually severe floods in 1996. Apart from the reports available in the media and what was officially stated by the government, there is a detailed account available from the Tarun Bharat Sangh (TBS), a voluntary group based in Alwar district.

According to the TBS there were several direct and indirect effects of the floods. For instance, the large number of cattle deaths and the flooding of pasture lands meant that milk yields were very low and child nutrition and health was severely affected. The waters also ruined grain stored in fields and houses leading to widespread hunger and malnutrition in an already deprived population. *Kuchha* wells collapsed, handpumps were submerged and *pucca* wells filled with polluted water causing dysentery, diarrhoea, jaundice, gastritis, worms, malarial fevers, traumatic injuries and insect bites. Tarun Bharat Sangh, therefore, painted a much grimmer picture than Nivedita had.

Nivedita had found that the flood and famine of East Bengal was beyond her comprehension. 'I had seen poverty in my life, plenty of it ... but I have never experienced anything that enables me to imagine what it means, to be one of what is officially declared to be eleven hundred thousand persons, all in the same district, who have not had a sufficient meal for months, and who even now are wholly dependent for what they expect to eat on a precarious charity.'

What do people do when disaster strikes them in such manner? How do they survive? What does it take to keep body and soul together through days together of wet, hungry, merciless existence? And once the waters recede how do they rebuild their lives?

Dinesh Kumar Mishra cites the example of Darbhanga in 1893, when the floods gave rise to fears that massive relief operations would have to be taken up in the affected areas. But, as the floods started receding, people started coming back to their houses, repaired them and got busy tilling the soil for the next crop. The government had opened relief works but not more than 700 to 800 persons turned up seeking jobs and the centres had to be closed shortly.

In 1906, though, Darbhanga was hit three times in a season by floods. About two-third of the population of Darbhanga state was affected and relief had to be organised for 1% of the population of the district till April 1907. Thus, within ten years, the people of Darbhanga found that their self-help mechanisms were of little use against the remorseless recurrence of floods and had to depend on what little help the administration could provide.

This assistance that was increasingly provided for the next 40 years was eventually made a part of government policy when the nation became free. And, in the 50 years since, those policies and programmes have been further refined until they are now part of the automatic response at the district level, demarcated by standard contingency action plans.

Does this mean that the traditional view, of the state bearing primary responsibility for relief in the face of calamities, is after all the correct one? That people are by nature helpless and dependent upon the administration? That those sections of society who are not themselves affected are apathetic to the condition of their fellows?

These questions must have agitated Sister Nivedita too, for she was moved to remonstrate: 'For if misery is apt to brutalise the sufferer, it is still more true that it deadens the witness. It is only, moreover, in proportion as we understand what constitutes the common weal and happiness of the victim, that we are able to make that subconscious comparison which enables us to gauge from his own point of view the extent of the disaster that has befallen him. So it was perhaps surprising that I often saw tears in the eyes of the young Bengali men who accompanied me on my famine-rounds, when I myself was conscious of nothing but the gasp of horror.'

It was these 'young Bengali men' who were at the heart of the relief work in East Bengal in 1906. Nivedita recounts how, in a wave of spontaneous action, the cities of Bengal began to send help to the distressed areas, when a Mohammedan peasant who lived near Barisal, walked into a police station and charged himself with the murder of his own three children. The father's cry was, 'Let me die! If I cannot earn food for those dependent on me, let me be hanged!'

In the town of Barisal a relief organisation was started which was able to involve the young men of the city, and through their means open relief centres in 160 different places in the district of Backergunge. In the words of the Sister, 'Amongst voluntary organisations, unrecognised by state or government, and taking place spontaneously in face of the need with which they were to deal, this, for rapidity of formation, loyalty to its leaders, cohesion, and efficiency, might well, I think, claim to be unprecedented in any country.'

Who were these admirable young people who could selflessly outdo the government in the darkest days of famine and flood? They were none other than the Barisal schoolmaster and his students! They successfully mobilised to distribute the aid pouring in from the cities. And they were matched in their motivation

by the young men who came from the cities. Sister Nivedita comments in wonder: 'The manner of the young men who distributed relief was most tender and respectful; their sympathy for suffering only too intense. In one case I found one of these workers removed but a short distance as it seemed from the physical condition of the starving people about him, and discovered that he could not bear the idea while in the famine districts of eating more than half of a man's daily allowance of food.'

And what about the people? Does charity make them insensate and unfeeling? Once again, Nivedita is our lodestone: 'So we gave to all a biscuit each. But was there any clamour or disturbance after this? Were there hoarse and menacing cries I had half expected, of "More! More! More!" Nothing of the sort. Indeed I do not know that anything I have seen in the villages has more impressed me with the pitiful realities of famine, than this fact that whole boat-loads of grown-up men and women turned homewards with the hurry and excitement of happy children, under the unwonted good fortune of having received one-eighth of an ounce of extra food apiece!'

Later, she adds, 'But the one lesson of my pilgrimage amidst the starving has been the immensity of the gulf that divides the humblest of citizens from these civic paupers. It takes a long series of scanty harvests to turn the poorest Indian householder into a beggar. Unless this is understood, we fail of the whole moral.'

Between 1906 and 1996, where has the flower of each succeeding generation gone? What happened to the motivations of yesteryear? Is it that the young have become callous and the people apathetic? Have people, particularly the poor, become used to government handouts and lost their own instincts for hard work and survival? Are we witness to a revolution in mores and values which is revealing the darker side of human nature, or are there social processes which have set off this change in attitudes by design?

Even in Sister Nivedita's time there were some clues to what was happening. 'I opened the morning newspaper on my return to Calcutta and turned eagerly to the famine returns for some nine different states and provinces... certain Madras officials had vetoed amongst the Madras people during the same period, the collection of funds for famine-relief in Southern India on the plea that *as famine had not yet been declared by the Government to exist, the organising of a fund on its behalf, was an act of sedition.*'

Even more revealing is what happened at the dawn of freedom. Addressing the massive task of national development as early as in 1952, Jawaharlal Nehru had said to the Planning Commission: 'Therefore, we have to look in our people, go to them, talk and discuss with them, and work with them. We must function as comrades in a common task, as partners in joint undertaking. We may have to teach them something but we have much to learn from them also.'

It was in tune with this sentiment that the Bharat Sevak Samaj (BSS) came into existence in 1952 with the express purpose of harnessing the people's voluntary energies in building the nation. One of the first projects related to flood management involved building the embankments on the Kosi so as to 'rid North Bihar of the menace of floods once and for all.' In 1954 it was officially decided that the work would be awarded to the BSS on the basis of pure voluntary work (*shramdan*).

Mishra has unearthed old records to show how successful this scheme was in the initial stages. Thousands of villagers – women, schoolboys, NCC cadets, even sadhus and convicts – travelled huge distances from, not only Bihar but all over the country to construct the embankments under conditions of great hardship. The response was so magnificent that the Auxilliary Cadet Corps was forced to issue a press release asking headmasters and teachers to 'note that the boys should come strictly according to the NCC circle commanders programme, otherwise reception arrangements which are sufficient for only 10,000 cadets will be entirely insufficient and will upset the programme.'

Mishra goes on to show that this response upset the officials and the contractors whose privileges and profits were being severely affected by the democratic upsurge which was completing the works in advance of targets at much lower cost and with enormous public transparency. 'They connived together to obstruct works taken up under the public cooperation schemes. They resorted to promoting contractors and delaying the payments to the BSS so as to frustrate the labourers working with them.' Consequently, within six months, the joint convenor resigned from his post. Gradually, the voluntary workers discovered that their services were not appreciated, that facilities were not provided in time.

As word started trickling back to the organisations where these workers come from, the flood of volunteers started drying up. This was used by vested interests to discredit the entire voluntary effort and turn the work over to regular contractors. Thus, the deliberate efforts to control, absorb, and eventually dishearten voluntary work and democratic functioning has

almost as long a history as voluntary work and popular action itself. And frequently the state itself contributes to this, even as it calls for greater 'people's and NGO participation.'

For instance, at a 1991 core faculty training workshop organised at Pondicherry and sponsored by the World Health Organisation, voluntary work was described by the deputy additional director general of emergency medical relief in the following manner: 'While a comprehensive body of knowledge and skill can exist in voluntary work in normal times, not much is available on that which is needed in critical times. In order therefore to reduce this gap and also to strengthen voluntary work it is desirable to undertake scientific studies of emergency welfare whenever possible.' In other words, the perspective is that government provides the expertise while voluntary agencies carry out the work.

Most voluntary groups have now come to share this thinking. They have become nothing more than appendages, sub-contractors and agents of the government. The invented term 'non-government agency' – which has come to characterise all 'voluntary' effort, although this modern version of voluntarism is now 'paid' for – is a good example of how the motivation of entire generations has been swallowed up by organisations deliberately built on the principles of greed.

Rohan D'Souza suggests that: 'Huge investments were also involved, with the Mahanadi scheme, for example, estimated at a cost of Rs 60 crore, i.e. equal to 25 years revenue of the province of Orissa. This must have, in effect, meant a substantial gain for engineering firms and contractors who would have particularly benefitted from such "development projects".'

What then is the solution? Is it merely technical? Or administrative? Or motivational? Or is it something much greater than all these? Through this exploration of floods as disasters, Sister Nivedita has kept pace with us, every step of the way, illuminating and prescribing the events of a full century. Even at the end she is still with us: 'As long as India is contented to *sit and argue* the question, he (the Englishman) is perhaps but worldly-wise to take what he can and refuse concession. Argument is never dangerous. But if a day should come when she ceased to argue? If she suddenly declared that she cared nothing about theory, for three hundred millions of human beings had *determined* on a new arrangement? "Not our right, but our *will*!" if this cry were heard throughout the land? What could be said by the tax-gatherers then? What then? What then?'

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The embankment trap

DINESH KUMAR MISHRA

A British engineer, while describing the flood situation in Assam and Bengal had once talked about 'the human interference with the rivers and how the situation grew progressively worse owing to the power of government and skills of engineers and how substantial bundhs have sprung up everywhere with the complication of embanked roads and railways.'[1] But that was said way back in 1937. Salberg was not the only person to have so observed. Captain Hirst (1908), while discussing the floods in the Hwang Ho basin had observed, 'Each succeeding generation has been compelled to raise the height of the embankments to make them keep pace with an ever increasing flood level: at the present time the river runs many feet above the surrounding country... and the pent up waters deal death to the posterity of those, who, originally in good faith, prepared the way of disaster.'[2] S.C. Mazumdar (1940) asserted that, 'For a short term gain the present generation is mortgaging the interests of the future generation by building embankments along the rivers.'[3]

The issue was one of holding flood waters in various river basins of the Ganga and Brahmaputra, and the debate focused on the performance of embankments along the rivers. These concerns were thrown to the winds in 1953 when one of Bihar's most glorious and restless rivers (Fig. 1) was proposed to be embanked, a process which was completed in 1957. Forgotten was the over hundred year old debate against embanking the Kosi. This single action of the government and the engineers paved the way for embanking most of the other rivers of the Ganga and Brahmaputra basin, but without any preparation or debate. The debate that led to the embanking of the Kosi has been recorded elsewhere and it is not being repeated here.[4]

However, it will not be out of place to mention that with the massive embanking of the Bihar rivers, the flood prone area of Bihar which was only 25 lakh hectares in 1952 now stands at 68.9 lakh hectares (1998). The state had 3,465 km long embankment along its rivers in 1998 (only 160 km in 1952) and a sum of Rs 746 crore was spent between 1952 to 1998 for flood control.

The Kamla (Fig. 2) is a small and insignificant river of north Bihar compared to the Kosi or the Brahmaputra. This river originates in the Mahabharat range in the Himalaya and after traversing 24 km through the hills, descends to the plains in the Dhanukha district of Nepal. 32 km later the river enters India at Jaynagar in Madhubani district. Notorious for changing course due to an excessive silt load, this river joined the Balan in 1954; the combined course is now called Kamla Balan.

This new course of the river was embanked in the early '60s, from

* The author expresses his gratitude for the help extended by his friends of Barh Mukti Abhiyan in writing this article.

1. Peter Salberg, 'Plain facts about floods in Bengal and Assam', as quoted in the Proceedings of the Patna Flood Conference, 1938. Superintendent, Government Printing, Bihar, Patna, p. 11.

2. Capt. F.C. Hirst, 'The Kosi River and Some Lessons to be Learnt From it', *Journal of the Asiatic Society of Bengal*, September 1908, pp. 465-466.

3. S.C. Mazumdar, *Rivers of Bengal Delta*, 1940, p. 19.

4. Dinesh Kumar Mishra, 'The Bihar Flood Story', *Economic and Political Weekly*, 32(35), August 1997, pp. 2206-17.

Jaynagar to Darjia, at an estimated cost of about Rs 4 crore. Some additional work was carried out in the late '80s to extend it from Darjia to Phuhia. Far from being complete, the work stopped some years ago, apparently due to a resource crunch. The river has a catchment area of 5563 sq km of which 3,600 sq km (64.7%) is located in India and the rest in Nepal. The river has a total length of 256 km in India and 72 km in Nepal. Its maximum observed flow at Jaynagar is 2208 cumecs and the annual run-off is estimated to be 2156 million cubic metre. The average annual silt load of the river at Jhanjharpur is 5683 thousand tonnes.

The Kamla embankments provide a live example of all the apprehensions expressed over decades. Should one stand on the road connecting Jhanjharpur and Darbhanga near the Naruar inspection bungalow and talk to anybody on the roadside, there is no escaping the bitterness with which people talk about the embankments. We will have a glimpse of it in the following paragraphs.

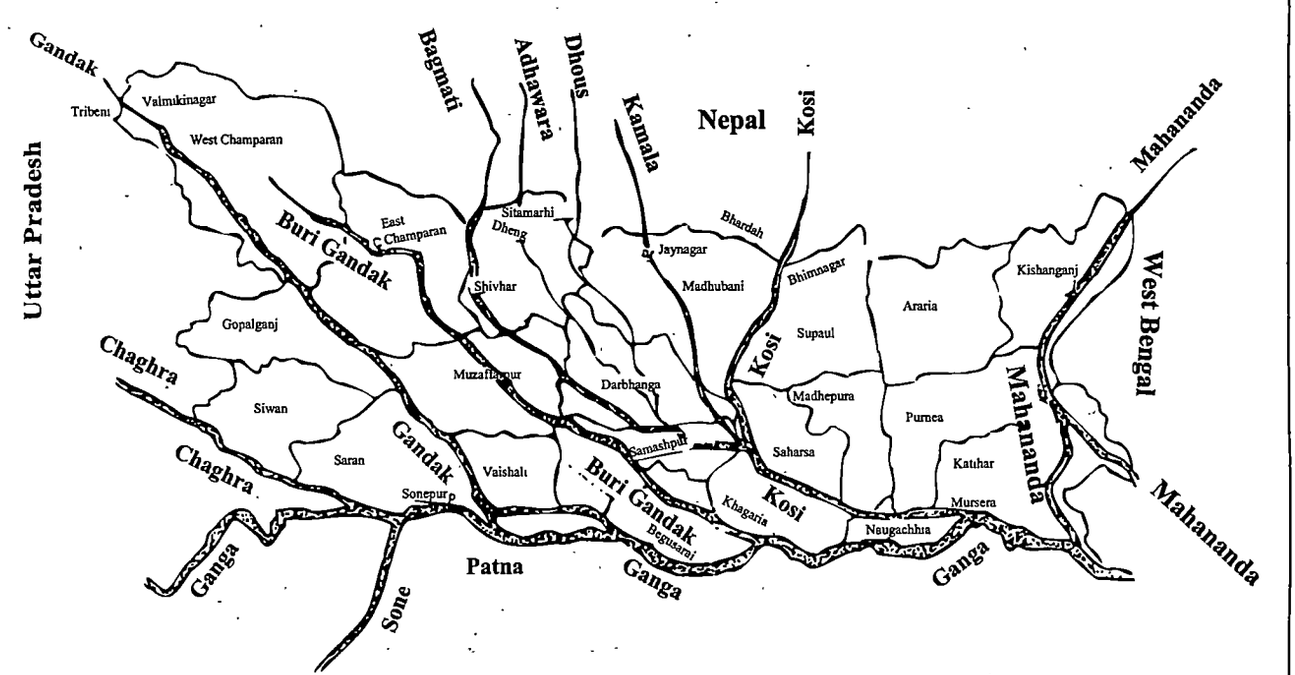
It is important to realise that when the river is embanked, the water which could have entered the river on its own gets stuck outside the embankments and causes water-logging. In addition, seepage from the embankments makes life worse for those living in the so called protected areas. The river water contains a lot of silt which spreads over a large area if the river is free to spill. This silt gets trapped between the embankments, continuously raising the bed level of the river, thereby pressing for raising the height of the embankments.

There is a practical limit to which the embankments can be raised. The trouble starts when a tributary joins the main river. The embankments on the main river block the entry of the tributary into the river and a sluice gate becomes necessary. When constructed, this sluice gate must be kept closed during the rainy season because any sudden rise in the flood level of the main river will push the flood waters into the protected area through the sluice gate. And if the sluice gates are closed, even for a short while during the rains, the backwaters of the tributary will submerge the protected areas on the country-side of the embankments, i.e., the area protected from floods. Consequently, the tributary is also embanked to prevent its spill.

This creates another problem. The rain water gets locked between the embankments of the main river and that of the tributary and can be taken out only by lifting through pumps or drying on its own due to evaporation. And to cap it all, no embankment has so far been built that will not breach. If any of the two embankments breach, whether on the main river or the tributary, the people living between the two embankments will meet a watery grave.

This knowledge existed with Indian engineers much before the embankments were okayed by them in the post-independence era. The political compulsions of the times forced them to toe the line of the politicians and in their enthusiasm to do so, the

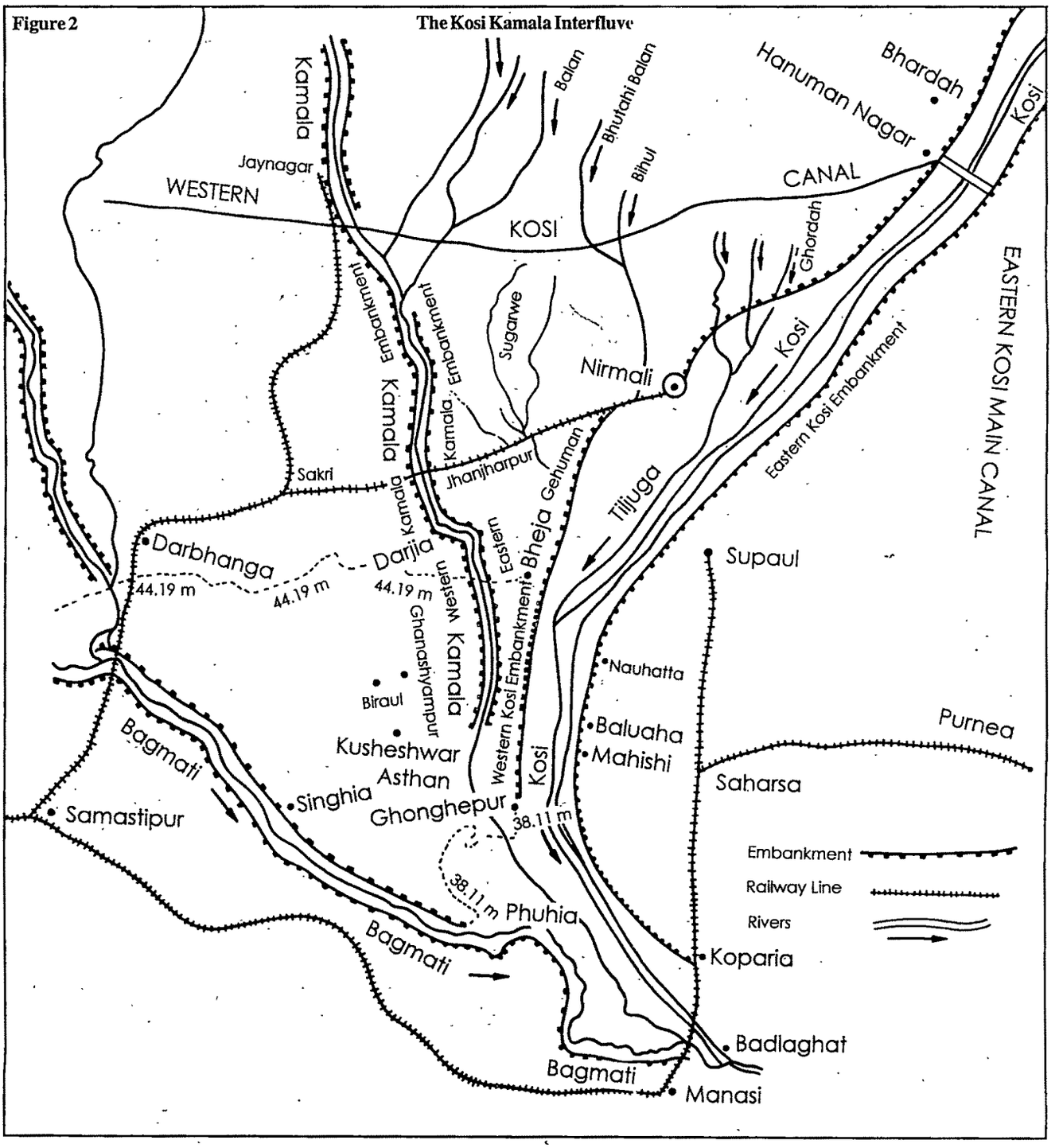
Figure 1 North Bihar and its Rivers



engineers went out of their way to negate what they had argued against for over a hundred years. They had to dig out another set of arguments saying that when a river is embanked, the waterway – the area of cross-section through which the water flows – is reduced which leads to a rise in the velocity of flow and hence the eroding capacity of the river water. The river resections itself by increasing its width and depth. Thus, the discharge carrying capacity of the river is increased and, as a consequence, the floods are also reduced. Such was the rationale which paved the way for the construction of embankments.

The colonial rulers were calculating and knew that if embankments were constructed through public money, it would become obligatory for the government to pay for all the relief and rehabilitation costs in case of any breach in the embankments. Also, that such costs would always exceed the benefits accrued over the years for the beneficiaries or the rev-

Figure 2 **The Kosi Kamala Interfluve**

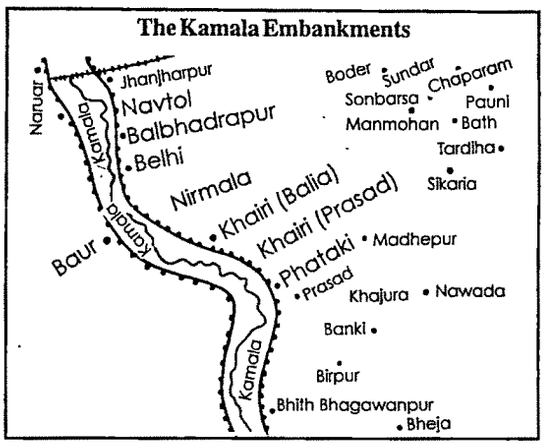


enue collected by the government as flood protection levy. Their engineers rightly spoke the language of their masters and so did the Indian engineers in independent India. To argue that technology is neutral and apolitical is hardly tenable.

The first phase of the Kamla embankments which were meant to protect 1.92 lakh hectares were completed in 1963. The construction of the embankments was started in 1957 but was considerably delayed because the wages offered to the labour were not comparable to the adjoining Kosi project and hence less labour was available.

There was a strong people's movement against this project under the leadership of Ram Parikshan Pandey of village Pirhi in the Babu Barhi block of Madhubani district. The people feared that the embankments on the Kamla would impede drainage, create water-logging in the countryside, deprive the area of the fertilizing silt that flood waters of the Kamla brought annually to their fields, and raise the river bed level. While the movement succeeded in stalling the construction of embankments on the eastern bank of the Kamla over a stretch of about 13 km, the rest of the embankments on either side of the river were soon completed.

The breaching of the Kamla embankments started almost simultaneously with its completion. In the year 1963 itself the embankments breached near Ramghat submerging the villages of Kharbar, Gangapur, Gunakarpur and Belhi. This was followed by a breach near Daiya Kharbari in 1964 on the left bank in the Lakhnour block. Innumerable breaches occurred in the embankment in 1965, flooding the blocks of Lakhnour, Jhanjharpur, Manigachi and Madhepur. It has been a regular affair ever since and 1968, 1971, 1974, 1979, 1985, 1986, 1987, 1988 (only erosion but no breach), 1991, 1993, 1995, 1996 and 1998 have been bad years flood-wise in the basin despite and due to the embankments.



In one of the worst floods of the century that were witnessed in Bihar (1987), the Kamla embankments were virtually smashed into smithereens breaching at as many as 24 points – at 13 points on the east and 11 points on the western side[5] – establishing the fact that embankments are like a fair-weather friend whose help is not available when needed most. Today, breaching of the railway line connecting Darbhanga to Jhanijharpur has become a routine affair near Naruar in the Jhanjharpur block as is the overtopping of the road cum rail bridge.

It was probably for the first time on 2 August 1985 that the Kamla embankments were cut by the irate villagers near the village Bhagiras to drain the water accumulated in the countryside. But the gap was promptly plugged by the government by 7 August 1985.[6] In 1993, the villagers of Bhith Bhagwanpur in the Kakhnour block of Madhubani district, who had regularly lost their crops over the past 15 years due to seepage and water logging, observed a fast unto death at the local block office demanding removal of the Kamla embankments. When this demand was not heeded, they cut the embankment west of their village.

Fifteen persons from the village were booked for threatening peace but no cases were reportedly registered against them. The emerging waters from the Kamla deposited silt in huge quantities in Bhith Bhagwanpur and the village land emerged out of water. The villagers have so far not allowed the government to plug this breach and the cut remains open. Since 1993, the village has reaped a good harvest.

The Bhith Bhagwanpur experiment set the ball rolling. In 1995, the east Kamla embankment breached at Navtol in Jhanjharpur and Balbhadrapur in the Lakhnour block of Madhubani district and the western embankment gave way at Naruar of the same district and at Baur village and Ghanshyampur block of Darbhanga district.

The villagers, taking a cue from the Bhith Bhgawanpur, organised along the left bank of the Kamla and effected as many as six breaches in the embankment at Belhi, Nirmala, Khairi (Balia), Khairi (Prasad), and Phatki (Prasad). In Nirmala the embankment was cut at two places on the same pretext as at Bhith Bhagawanpur. In the *rabi* season of 1995-96, villagers of Nirmala sold green gram worth Rs 1,30,000 as the production shot up due to rejuvenation of their lands through deposit of silt. They had experienced a good harvest after 10 years. These breaches were, however, plugged.

In 1996, the eastern embankment of the Kamla breached once again at Navtol, Balbhadrapur and Phatki and was cut by the villagers at Nirmala. In 1998, the embankment

5. *Barh 1988* (a report), Superintending Engineer, Flood Control, Planning and Monitoring Circle, Bihar Sarkar, Jal Sansadhan Vibhag.

6. Flood and Drainage Problems of Bihar and Their Remedial Measures. Report of the Second Irrigation Commission 1994, Vol. V., p. 548.

breached at three places on the western side near Gopalkha (42 km from Jaynagar), Jaidevpatti in the Ghanshyampur block of Darbhanga and at Baur in the Goura-Bouram block of the same district. It is believed that these breaches were effected by the people and with so many breaches on the western side there was no need to cut the embankment on the east.

The cut at Gopalkha was effected by the people with the intention that their dwellings should remain intact and only the land would get the water and silt. However, the citing of the breach was wrong and did not yield the desired result. In fact, the embankment was weak between Gopalkha and Ram Ketari and could breach any moment washing away Gopalkha. That was the reason to breach the embankment at Gopalkha. The breach has, however, blocked the countryside drainage and the lands of the immediately upstream village, Thengaha, got choked. One would not be surprised if the villagers of Thengaha do a Bhith Bhagawanpur on the embankment during the next flood season.

A section of people, however, believe that the Gopalkha breach was effected by the government to save the sub-divisional headquarters at Jhanjharpur from flooding. The situation is so chaotic near Jhanjharpur that some 1,500 hectares of land is still waterlogged at Partapur near Chamrahi where the embankment had breached in 1987. The sediment that emerged from this gap covered a vast area of Jhanjharpur town and blocked the drainage of the countryside converting it into a permanent pool. Agriculture has not been possible on this land since 1987 and the people await a breach upstream from Partapur to take place so that their land emerges from waterlogging conditions. But before their land is reclaimed, Jhanjharpur town will suffer immense damage. Thus a trap is laid: one section of people can pray for its safety only at the cost of the other.[7]

Blaming anti-social elements for breaches in the embankments is not new. It started in the middle of the 19th century when British engineers found it hard to explain the breaches in the Damodar embankments. As they were unable to appreciate indigenous methods and coping mechanism of the 'natives', they passed the buck on to anti-social elements.[8] The technique got a new lease of life in 1991 when the minister of the department of water resources in Bihar boldly asserted that no embankment in the state would be allowed to breach and should it happen he would resign his post.

Immediately after he said so, the western Kosi embankment got eroded near Bhardah in Nepal and his own partymen demanded his resignation; he readily obliged. It is altogether a different matter that his resignation was not accepted. It became customary after that to book all cases of breaches onto the account of anti-social elements. Earlier, the breaches were blamed on rats and foxes who dug holes through the body of the embankments, making way for water to seep through. Four breaches that occurred on the Kosi near Jamalpur in 1968 were investigated by a senior engineer, B.S. Nag, and rats and foxes were blamed for the debacle. The public was neither amused by the rat-hole theory then nor is it convinced by the anti-social theory now. No one asks the authorities as to why 'anti social elements' do not opt for less risky jobs than breaching embankments.

The fact that the so called anti-social elements breach embankments only when their lives are at stake, and the fact that their kith and kin dwell in the same area through which the flood waters will pass is conveniently forgotten. Also, that a number of breaches occur every year because of the callous indifference of the authorities who are never brought to book because of procedural loopholes. It is unlikely that such lapses are ever inquired into and action taken against the erring authorities. The famous Kosi embankment breach of 1984 and the Dholi breach of the Burhi Gandak (1987) are cases in point.

It would be another matter if the breaches were only a result of a technical lapse. They affect the life of the locals directly. The devastation is less if the breach is deliberate because it is done with a definite purpose with all precautions taken; when it is sudden and has to be faced without preparation, the impact is horrifying. It is also immaterial whether constructing embankments is in itself good or bad. What is certain is that they have changed the function of the rivers. The rivers are meant to drain the water of a given area, but embankments have forced them to spread the waters into their catchments. Nothing can be more crazy than that. When a river changes its function, society comes to a stand-still and north Bihar is a testimony to this.

The breach of an embankment is, in fact, a breach of trust, a trust that existed between the people and the builders of embankments – whether politicians, engineers or contractors. Everytime a team changes it conveniently blames its predecessors for the problems and exonerates itself of all responsibility. It becomes easier

7. This information is based on various newspaper reports, official documents and personal communication over the years.

8. William Willcocks, 'The Ancient System of Irrigation in Bengal and its Application to Modern Problems', Calcutta University Readership lectures, 1930, p. 59.

for the politicians if their political affiliations are different. Thus, in Bihar, the present regime finds it convenient to pass the evils of flooding onto embankments, since it has not participated in the 'sin' of constructing them. Unfortunately, the people believe them just as they believed their predecessors. What they do not know is that the present regime too is ready with plans to construct fresh embankments and is unable to do so only because of a resource crunch.

In 1998, the flood controversy touched new heights in Bihar. There was an unprecedented flood in the state which manifested itself in the month of July and continued till September. It was during this period that the CAG report was published, which indicted the government for showing laxity towards flood control measures.

The report noted that, 'The impact of floods have increased manifold since 1988 because of the stoppages of flood control measures, the inability of government to complete jobs in hand, carelessness in maintaining the existing embankments and not taking up of suitable drainage works during the period 1992-93 and 1995-96. The human loss which was limited only to four in 1992 rose to 269 in 1996 and the cattle losses rose from zero in 1992 to 3742 in 1996. The loss of crops and other properties went up from Rs 0.75 crore to Rs 289.56 crore between 1992 and 1995.'[9] This was excellent ammunition for the leader of the opposition in the Bihar Vidhan Sabha. He sat on *dharna* at Darbhanga in the month of August to highlight the plight of the people and the inaction of the government.

The government, not unexpectedly defended itself. Through a press release on 10 August 1998 the water resources department of Bihar asserted that, 'Because of the heavy current of the river water and the resulting pressure on the embankments, there have only been seven breaches in the embankments of the irrigation department, and at seven or eight places the embankments have been cut by the villagers to fill up their lands, drain the water into the river or clear the water logging. To say that the embankments have breached at 125 points is baseless.'

Further, it is far from the truth to say that the flood in north Bihar is caused due to the breaches in the embankments of the irrigation department. The fact is that there has been an attempt to protect 29 lakh hectares of land by constructing 3465 km long embankments and there has been no work done to protect the remaining flood prone area of 39 lakh hectares.

'The irrigation department is responsible only for protecting the 29 lakh hectares and is in no way responsible for the protection of the maharaji bundhs, zamindari bundhs, ahars and pynes etc. When such structures breach, the people's representatives and the press, out of ignorance, charge the irrigation department of the breaches. It is almost certain that the floods will be there in the unprotected area of 39 lakh hectares because no work has been done in those areas...'[10]

There are many questions to be answered at this stage:

(*i*) 1992 saw one of the worst droughts in the state since 1972, so why should that year be used as a reference year for floods?

(*ii*) Who is responsible if the people suffer floods in the said unprotected area of 39 lakh hectares because not even an inch has been added to the flood protected area of the state in the last 10 years?

(*iii*) If there are seven breaches in the flood protected area, will someone be held responsible for the lapse and action taken against him?

(*iv*) When zamindari areas and the princely states were taken over by the government, one presume that it was with all their assets and liabilities. Can the government absolve itself of the liabilities it inherited along with the assets?

(*v*) Will the government tell the people which department looks after the maintenance of the ahars, pynes and the zamindari and maharaji embankments, at least for the future?

(*vi*) Will the government publish a map of the state clearly marking those 39 lakh hectares which are unprotected and where the people are expected to fend for themselves during the floods?

In all probability, nobody is likely to answer these questions. The government, at best, may claim that the flood problems in the Kamla basin can only be solved when a dam is built on the river at Chisapani in Nepal. Similar statements were made about the embankments some 40 years back. The carrot of a Chisapani dam has been dangled before the people in the Kamla basin for the past 52 years and one does not know whether this dam will ever be built. Whether it will be effective in controlling floods is doubtful given the growing awareness about the environment.

To identify the problems, an assessment of the embanking scheme is the need of the hour, for unless the problems are known the solutions cannot be worked out. But for now, everything is not all right with the Kamla embankments.

9. *Bharat ke Niyantrak – Mahalekha Parikshak ka 13 March 1997 ko samapt hone wale varsh ka prativedan*, No. 3 (Civil), Bihar Sarkar (Hindi), p. 392.

10. Press release, 10 August 1998, Jal Sansadhan Vibhag, Bihar Sarkar.

Need for a realistic view

JAYANTA BANDYOPADHYAY.

IN respect of the total annual outflow of water from a river basin in the world, the Ganga-Brahmaputra-Meghna (GBM) basin in South Asia stands a close third to the Congo-Zaire in Central Africa. The latter drains about 1460 cu km of water annually, while the former drains about 1400 cu km. However, in stark contrast to the low population density of the African river basin, the GBM stands out globally in terms of sustaining a very high density of human population. This is particularly so in the Ganga sub-basin and in parts of the Brahmaputra sub-basin downstream from the Assam plains.

A monsoonic climate system operates over the basin, thus resulting in acute temporal inequities in precipitation. The summer monsoon brings down about 80% of the annual precipitation during mid-July to end September, which accounts for about 20% of the total time-span of the year. A substantial part of this rainfall occurs along the Himalayan foothills. As a result large monsoonal outflows in the streams and rivers in the foothills regularly inundate wide areas in the adjoining plains. In the popular imagination of today, this is recognised as floods.

Every year these floods cause tremendous human suffering and economic loss in many parts of the basin. The areas vulnerable to the floods are along the plains adjoining the Himalayan foothills from East Uttar Pradesh to Nepal to Assam and almost the whole of Bangladesh through which this enormous volume of water finally drains into the Bay of Bengal. The high level of poverty of the basin population is often attributed to the regularly occurring floods in the monsoon period and, conversely, scarcity of water after the monsoon rains are over.

There are several pros and cons for the occurrence of such a skewed precipitation and river flows. In order

to address issues of water resource management in the GBM basin in a holistic manner, a clear understanding of these factors is important. The quantitative picture of this great temporal variation is apparent from a comparison of the recorded flows at different times of the year for the Ganga and Brahmaputra. The peak flow of the Ganga and Brahmaputra before their confluence touches 46,000 and 51,000 cumecs respectively during the monsoon, while the corresponding lowest flow figures during the summer may be around 2,000 and 5,000 cumecs. Such a wide difference between the lean and peak flows is characteristic of monsoonic climate, though the flow of the main rivers of Ganga and Brahmaputra show a more averaged out picture. The difference would become even higher in the case of the Himalayan tributaries to these main rivers like the Teesta, Kosi, Bagmati and so on.

The temporal variations in the river flows and their economic and environmental fallouts are important in shaping the socio-economic transformations in the downstream areas. The monsoon precipitations make the rivers swell and when they emerge from the foothills and reach the plains, they become far wider as the flows spread over larger parts of the floodplains.

In a geomorphological sense, the making of the Ganga-Brahmaputra-Meghna basin has literally been the contribution of the monsoon floods and the sediment they deposit. The fertile lands in the lower parts of the basin have been built over millions of years of deposition of silt brought by the monsoon floods. Many powerful kingdoms and empires that had shaped the history of the region, flourished on the banks of these rivers which drain the waters of the Himalaya and its foothills. Today much of this region, particularly parts of eastern Uttar Pradesh and Bihar bordering Nepal, constitute areas where economic prospects are seen as increasingly bleak.

An examination of the ecological peculiarities of the region would be beneficial for understanding such contrasting periods of glory and marginalisation of these flood-ravaged areas. The hydro-meteorological features of the Ganga-Brahmaputra-Meghna basin are governed mainly by the interaction of the atmospheric circulation with the Himalayan mountain range. With its average altitude of more than 7,000 metres, the Himalaya forms a formidable obstacle to atmospheric circulations. As a result, the monsoon currents cannot cross the Himalaya, forcing the south-west monsoon to change the direction of the flow north-west along the foothills.

The Himalaya successfully and gradually extracts the immense amount of moisture carried by the monsoon winds. Most precipitation occurs in the eastern Himalaya and by the time the monsoon currents cross into Himachal Pradesh very little moisture is left. This precipitation takes place exclusively on the southern aspect of the Himalaya and is characterised by a continuous spatial variation in the level of precipitation. This ranges from a high of about 11,000 mm near Cherrapunji in the East to a low of about 400 mm near Ajmer in the West. This makes for a strong and continuous disparity in the average precipitation along the Himalayan foothills and is at the core of many problems related to amicable sharing of the Ganga waters.

In addition, the overall direction of the flow of the Ganga further accentuates the regional imbalance in the monsoon precipitation. The overall directions of flow in the Ganga subbasin being from west to east, the natural flow of the river carries water from the drier western parts to the eastern parts which receive a much larger annual rainfall. Under such circumstances, another type of flood occurs – from simultaneous arrival of peak flows in the various tributaries at the point of confluence. Such floods from drainage jam have often occurred under a perfectly blue sky.

An additional special characteristic of the Himalayan rivers is that during the flood flows they not only carry a lot of water, but more importantly also a lot of solids. The Himalaya is an unconsolidated mountain, shaken internally by frequent seismic movements and hammered externally by the ferocity of regular monsoon rains. Both soil erosion and large landslides that result, produce a lot of solid mass that finally lands up on the riverbeds. It is then upto the strength of the river flows during the monsoon to carry the solids downstream.

The boulders travel a small distance till the outer Himalaya, the pebbles a little more to the foothills, and finally the finest silt reaches the Bay of Bengal, continuously creating new landmass below the sea. This is a distinctive feature of the eco-hydrology of the Himalayan rivers. Traditional calculations based merely on rainfall data and volumes of water flow, thus, are bound to fail or become redundant in the practical context of addressing the floods in the Himalayan rivers.

Probably due to the enormous ferocity and regularity of monsoon inundations, human societies living in the floodplains of Himalayan tributaries had intelligently accepted these inundations as part of an unavoidable natural process. Thus, they developed a symbiotic approach to them. The land use got optimised and cropping pattern was chosen on the basis of these natural inundations. The indig-

enous architecture respected the rights of the rivers to spread out during the monsoon and in designing houses left sufficient space for flood-waters to move. In this way the rivers had free space to spread themselves during flood flows and the floodplains received vital supplies of silt and moisture which replenished the soil, both physically and chemically.

In order to promote commercial cropping, the British initiated engineering interventions on the Himalayan rivers. This was taken up largely on the basis of a knowledge base that evolved on the basis of their experiences with the European rivers. These rivers flow along stable courses, carry very little solids and show comparatively lower variations in the annual flow characteristics. In independent India, the need for land and water for growing more food nudged political leaders and technocrats into taking up projects in that engineering tradition.

Though there have been a number of impressive technical successes in managing Himalayan rivers to provide irrigation waters and generate hydropower, like in all fields of engineering application there have also been some failures. These failures are as much technical as socio-economic. The economic life of dams has often been drastically reduced by the sediment load which had been underestimated. The record of rehabilitation and compensation of people displaced by water-related projects has not been good at all. Unfortunately, there is a great reluctance among water resource professionals in India to address these failures and improve upon the past. This has led to a stagnation in their ability to develop better policies and practices.

The growth of knowledge cannot be halted by sidestepping problematic issues. It is only through an analysis of failures that future successes can emerge. On the other hand, taking these failures as sufficient reasons for stopping all human interventions into the Himalayan rivers and leaving them in their 'pristine natural state', some people demand a total ban on human interventions in the rivers. They, however, do not explain how the people can live without interventions on the nation's watercourses. The Himalaya is there to stay, as much as the monsoon is there to arrive annually as expected. During the monsoon, great volumes of water will continue to flow in the Himalayan rivers and some areas will continue to be inundated by these flows. Equally, human interventions backed by a search for a holistic understanding of the rivers will also continue.

It is imperative that efforts at enriching the holistic knowledge base are taken up at the earliest. It is likely that a more comprehensive knowledge base would help generate different type of feasible engineering interventions. This will reduce the level of abstractness in the hopes of the common people about engineering interventions on the Himalayan rivers generated mainly by politicians and technocrats. At a wider geographical level, a more holistic knowledge base would help in fostering hydro solidarity among the countries sharing the waters and floods of the GBM basin. In particular, the three countries of Bangladesh, India and Nepal would benefit from the evolution of such a knowledge base.

It should be noted that at the moment a diversity of expectations from water-related projects on the Himalayan rivers have strong nationalistic undertones. The objectives of engineering interventions are different for different countries. Bangladesh hopes that the problem of downstream scarcity of water in the Ganga basin may be solved by the construction of high dams on the Himalayan rivers in the foothills of Nepal. These dams, they hope, would store part of the monsoon flows to augment the flow in the Ganga during the lean period prior to the arrival of the monsoon. The people of North Bihar dream of high dams in Nepal that would altogether stop the flow of flood waters from crossing the borders and so make their region flood free. Other areas of India hope that high dams in Nepal would generate a lot of electricity and usher in a period of abundant power supply, much needed for fast economic growth.

Nepal hopes that the flood flows could be converted to 'hydro-dollars' against the tremendous locational advantage the country has for water storage and dam projects. In turn, such income could, in principle, help Nepal address the question of poverty. Surely, there is no one project design that will satisfy these diverse objectives. Moreover, in the background of the acute nationalistic implications that the waters of the GBM have gathered in the South Asian region, any deviation from these strictly individual agendas is sure to face political resistance, however beneficial a more collaborative approach may be to the largest collection of poor people in the world who live in the basin and also suffer the most from floods or droughts.

What then is a wise approach to the future? There is no doubt that protection from floods and droughts should receive high priority throughout the region. Nowhere else in Asia does there exist a more urgent need for regional collaboration on water resources. The prospects of economic advancement and poverty alleviation in the region depend precariously on regional collaboration on various fronts, including hydro-solidarity.

Another major drawback in the sphere of water related collaboration in the region is that the decision makers in these countries have thought mainly of large projects alone. Big problems need not have only big solutions. The present trend is probably more a result of electoral promises by politicians and is a gift of the 'traditional' education of the technocrats. Whether it is flood control or large storage for irrigation or power generation, the project designers are not on firm ground in terms of comprehensive and interdisciplinary knowledge on the GBM basin. This is not to question of the competence of the water resource professionals in the received form of knowledge. However, only at the cost of being arrogant can one say that the last word on eco-hydrological knowledge for this region has been uttered.

This makes a case for learning through smaller experiences before taking up larger projects. Small and large are relative and not absolute size categories, subject to correction on the basis of available knowledge. For example, the canals in the Vijayanagara empire were surely very large projects at the time. Today, when river waters are shifting over hundreds of kilometres, their scale may soon be included in the category of minor irrigation. The discipline of water resource management in South Asia also stands to gain through learning from experiences of more recent projects. The positive as well as the negative aspects of, say, the performance of the Kosi embankments in North Bihar, will be immensely beneficial for advancing our knowledge of the ecology of floods in the Himalayan rivers. Consequently, such a review will be vital for the design of any new projects to contain flood damages in the GBM basin.

All this points to a need to be somewhat more practical in our hopes and for politicians to be more realistic when making electoral promises about controlling floods in the Himalayan rivers. The same is the case regarding the possibilities of reaping economic harvest from the use of stored waters, whether for irrigation or supplies to megacities and generation of hydropower. There is little doubt that if India enters the next millennium with dry water tanks in the megacities and empty aquifers in the rural areas, indications of which are ample, political pressure for storing part of the flood flows in the Himalayan rivers will mount.

Large storages need large dams and the idea of large dams in the Himalaya, till today, has continued to feed hope. Several locations suitable for storage have been identified and work has started in a few. The simple truth that there is a great shortage of dependable vital information like the sediment load in the Himalayan rivers which cannot be ignored. The involuntarily displaced people should no more be asked to vacate their livelihood bases with the help of a colonial instrument like the Land Acquisition Act. The raging controversy about the seismic safety of the designed structures cannot also be wished away.

Before taking up new large projects it is surely wise for dam builders to focus on addressing these aspects of dams on the Himalayan rivers. It is undeniable that the simple arithmetic of water supply and requirements in South Asia will soon become a strong enough justification for building large dams on the Himalaya. However, there is no justification to push the large dams down the throat of the people merely as 'temples of modernity' while ducking the above scientific questions and controversies. What is needed are good and effective dams, not merely dams that are large in terms of size and budget. And good dams cannot be built with bad science.

Coming to the question of flood protection in the Himalayan foothills and the adjoining plains, it does not stand to reason that monsoon floods can be stopped by building dams. There are as yet no clear scientific indications that dams in the Himalaya would help in stopping floods in the foothills and adjoining plains. There are no easy solutions because the Himalayan foothills are also an enormous non-point source of flood-waters. Abstract hopes can be raised but non-point floods cannot be contained by solutions applicable in the case of point sources of floods.

The classical wisdom of treating floods in the Himalayan rivers as a natural process and adjusting human economic activities, especially farming practices, to extract maximum positive advantages, should be the basis of our realistic hopes in the next millennium. Non-point solutions are needed to address non-point sources of floods. Thus, flood management cannot be an exclusive responsibility of the irrigation departments and people need not reduce themselves into mere recipients of flood relief. There are larger issues on the agenda that the hydrologists need to address. These include collaborative monitoring of precipitation and streamflows and advance flood warning.

At the level of the common people, a movement for micro-level conservation of flood-water in local ponds and lakes all along the foothills will not only reduce the intensity of floods, but also reduce the intensity of water scarcity that follows. Above all, such steps would help the people get out of the 'disaster syndrome' which robs them of their self-confidence in facing floods.

Assam's woes

PROMODE GOGOI

ASSAM with a geographical area of 78523 sq km and a population of 221.40 lakhs (1991) is located in the north eastern region of India which consists of seven states–Assam, Arunachal Pradesh, Nagaland, Manipur, Meghalaya, Mizoram and Tripura. The north eastern region has a geographical area of 255650 sq km which is about 8% of the total geographical area of India. This region has two principal drainage systems, the Brahmaputra and the Barak, which along with other rivers in the region account for one-third of India's total water potential.

The Ganga-Brahmaputra-Meghna basin is the second largest basin in the world, next only to the Amazon in terms of run-off. The Brahmaputra river is one of the largest (6th largest) rivers of the world. Originating in the northern-most chain of the Himalaya in the Kailash range at an elevation of 5150 metres, it passes through Tibet (China), India, Bhutan and Bangladesh. The basin area is 58 mha (million hectares) of which 29.3 mha lies

in Tibet (China), 24 mha in India and Bhutan and 4.7 mha in Bangladesh. The state-wise distribution of the Brahmaputra basin in India is as follows: Arunachal Pradesh 8.14 mha; Assam 7.06 mha; Nagaland 1.08 mha; Meghalaya 1.17 mha; and West Bengal 1.26 mha.

The total length of the Brahmaputra is 2906 km out of which 1625 km is in Tibet (China), 918 km in India and 363 km in Bangladesh. The river has braided channels in most of its length of 640 km in Assam (India). The average width of the valley is about 80-90 km of which the main river itself occupies 6 to 10 km. The soil in the valley is mostly alluvium and is easily eroded.

In India, the Brahmaputra river is joined by 41 important tributaries, 26 located on the north bank and 15 on the south bank, in addition to the three main tributaries – the Dehang, Dibang and Lohit. In the North, the principal tributaries are the Subansiri, Kameng, Manas, Dhansiri(N), Puthimari, Pagladiya, Champamati, Sankosh and the Saralbhanga. In the South, the main tributaries are the Noa-Dihing, Buridihing, Desang, Dikhow, Dhansiri(S) and the Kapilli. The Brahmaputra has some important tributaries flowing through North Bengal. They are the Teista, Jaldhaka, Tors, Kalijani and Raidok.

The maximum peak flow of the Brahmaputra recorded at Pandu is 72794 cumecs in 1962 and 78449 cumecs at Jogighopa in 1972. The low water discharge at Pandu is about 2800 cumecs during the months of January/February. Observed maximum HFL (Highest Flood Level) at Pandu is 49.66 m. The average annual run-off (yield) of the Brahmaputra at Pandu is 49.43 million ha m (400 million ac ft). The maximum annual yield is 64.39 million ha m. About 80% of the flow occurs during the monsoon period from May to September.

The percentage contribution of yield by the major tributaries of the Brahmaputra at Pandu is as follows: Dihang at Pasighat 34%; Dihang at Jiagaon 7.65%; Lohit at Digarughat 9.5%; Subansiri at Chowldhowaghat 10.3% and other tributaries above Pandu 38.55%

The North East is geographically the most unstable part of India due to the frequent seismic disturbances. Four earthquakes of severe intensity, with a magnitude on the Richter scale of between 7 to 8 and above, occurred in 1869, 1897, 1934 and 1950. These great earthquakes are associated with large scale topographical changes. Vast tracts of land are either uplifted or get subsided by several feet and consequently alter the drainage system of the area. This change in topography has generally been responsible for the occurrence of floods and disturbances caused by earthquakes.

The three north bank tributaries of the Brahmaputra – the Dihang, Dibang and Lohit – carry the highest sediment load. Over 70% of the annual average silt load at Pandu is contributed by these three tributaries. As the most silty river in the Brahmaputra basin, the Subansiri carries large quantities of sand, silt and boulders, much of which is coarse sediment. The volume of sediment load (suspended) carried by the Brahmaputra, based on measurement at Pandu varies from 36609 ha m (1958) to 1487 ha m (in 1973) per year. About two-thirds of this volume is carried in the months of July and August.

Flood and bank erosion are the two major problems of Assam. Under the influence of the south-west monsoon, the Brahmaputra valley is subjected to severe and recurring floods. Heavy rainfall ranging from 2480 mm in the Brahmaputra valley to 6350 mm or more in the north eastern hills, largely concentrated during the four to five monsoon months, is responsible for frequent and damaging floods.

There has been disastrous erosion at numerous locations along the main river, large areas being eroded every year. The chief cause of erosion is the instability of the river which is due to high silt charge much beyond its carrying capacity. The high sediment load which the Brahmaputra carries is mainly due to the frequent seismic disturbances of low magnitude disastrous earthquakes that occur from time to time in the region.

After the great earthquake of 1950, the Brahmaputra and many of its tributaries experienced major topographical changes causing heavy silting of the river beds due to land shift and erosion in the upper reaches. Prior to 1950, the annual average silting rate at Dibrugarh was 3 cm, but after the 1950 earthquake the river aggraded at Dibrugarh by about 3 metres within a period of 10 years.

Further, the river in its course passes through some deep and narrow throats followed by broad, shallow degrading reaches. There are several such nodal points all along its course where the velocity increases and the river section becomes narrow and deep. Upstream and downstream of the nodal points, the river fans out and maintains a relatively low velocity, discharging its excess load and causing erosion in its basins.

Another important factor is its tendency to shift southwards due to the deposit of heavy silt by the north bank tributaries at their confluence with the main river. So erosion is more pronounced on the south bank. The town of Sadiya at the confluence of the

TABLE 1

State	*Area liable to floods (lakh hectare)*	*Area protected (lakh hectare)*
Assam	31.50	13.050
Manipur	0.80	0.730
Meghalaya	0.20	0.750
Tripura	3.30	0.091
West Bengal	26.50	10.010

Dibang and the Lohit disappeared in 1953. In 1954 the erosion at Dibrugarh was so severe as to endanger the town. A major part of the town of Palasbari disappeared that year.

There has been erosion at a number of other towns on the river bank at Kokilamukh, Majuli, Moriaholla, Tezpur, Dhing, Palasbari, Gumi, Mukalmua, Goalpara, Dhubri, Maijan-Nagagholi, Neamati-Hatisal, South Salmara among others. Bank erosion and sloughing are also very common in the tributaries.

The maximum area flooded in any year has been considered to be the area liable to floods. According to the report of the National Commission on Floods (1980), the state-wise areas liable to flood and the areas protected in respect of a few states are given in Table 1 above.

The Assam valley experienced severe floods in 1988. The total area affected was 38.23 lakh hectares which exceeded the above mentioned figure of 31.50 lakh hectare. Areas liable to flood in Assam and India as a whole, as estimated by the National Flood Commission, are 3.15 mha and 34 mha respectively. Assam thus accounts for 9.4% of the total flood prone area in India.

TABLE 2

Flood Damage in Assam 1953-1995

	Total	*Maximum*
Area affected (in million hectares)	41.66	3.82 (1988)
Population affected (in millions)	98.10	10.47 (1987)
Damage to crops		
(a) Area (in million hectares)	5.08	1.13 (1988)
(b) Cost (in rupees crore)	3288.31	334.10 (1988)
Damage to houses		
(a) In numbers	33,27,189	4,99,835 (1988)
(b) In rupees (crore)	296.80	103.92 (1988)
Number of cattle lost	431537	108913 (1987)
Number of human lives lost	1724	226 (1988)
Damage to public utilities (in rupees crore)	832.42	225.82 (1988)

Flood and erosion cause enormous damage to the crops, livestock, land and property inflicting untold misery on the people. An assessment of flood damage from 1953 to 1995 presents an extremely gloomy picture of the state of Assam. Table 2 reflects the total and maximum flood damage in Assam during the period 1953 to 1995.

The average annual loss/damage due to flood is about Rs 1000 million for the north-eastern region of the country of which about Rs 800 million is accounted for by Assam alone.

After the heavy floods in the country in 1954, the Government of India announced a national flood policy comprising three phases: immediate measures, short term measure, and long term measures.

The main focus so far has been on the construction of embankments, primarily because this can be done quickly with local resources, protecting large areas through relatively smaller outlays. Some work of drainage improvement, river training and bank protection and major town protection has also been undertaken. In addition, the Government of Assam carried out some dredging work in the Brahmaputra purely on an experimental basis for channel improvement. The performance of dredgers in a river like Brahmaputra, however, proved to be unsatisfactory.

Over the years the Assam government has constructed the following works: in the Brahmaputra valley, (*i*) Embankments: (a) Brahmaputra 984 km (b) Tributaries 2568 km; (*ii*) Anti-erosion schemes 421; (*iii*) Drainage channel 600 km; and (iv) Sluices 56. In the Barak valley, (*i*) Embankments: (a) Barak 214 km (b) Tributaries 524 km; (*ii*) Anti-erosion schemes 81; (*iii*) Drainage channel 247 km; and (*iv*) Sluices 29.

These short term measures have afforded protection to an area of 16 lakh hectares out of the total flood prone area of 31.5 lakh hectares. Construction of most of these flood control structures was completed in phases between the period 1955-56 to 1982-83. But they have now been found to be inadequate as they were based on insufficient hydrological data. This has resulted in a large number of breaches occuring every year, specially during high floods. Continued erosion and poor maintenance of the embankment due to paucity of funds has augmented the problem.

Since 1954 the central and state governments constituted several committees with national and foreign experts to review the flood problem and to advise on policy matters. They agreed that flood embankments alone would not provide the required protection and that they must be backed by storage reservoirs for moderating floods and trapping silt.

The various reports (1965, 1970) further stressed the need for construction of suitable multipurpose dams on the upper reaches of the main Brahmaputra as well as on its tributaries as a long-term measure for effective flood control and stabilisation of the river system with bulk hydropower generation for economic development of the region. Towards this end dams were

proposed on seven tributaries – the Dehang, Subansiri, Debang, Lohit, Manas, Sankosh and the Teesta. Investigation of these projects was taken up over a decade back with priority accorded to the Dehang and Subansiri projects.

The Brahmaputra Board was constituted by an Act of Parliament in September 1980 to prepare a master plan for control of floods and bank erosion and for improvement of drainage in the Brahmaputra valley with due regard to the development and utilisation of water resources. Pursuant to this mandate, the Board assessed the water potential of the river and proceeded to plan for harnessing it for beneficial uses, according priority to flood control.

In 1983, while the Board was engaged in preparing a master plan for the Brahmaputra river, it submitted to the Government of India reports for the Dehang dam and the Subansiri dam projects. Both projects were part of the master plan. The Board further submitted a master plan for the main stem of the Brahmaputra to the GOI for its approval alongwith master plans of some important tributaries of the river.

In the master plan for the main stem of the Brahmaputra, the Board identified 15 important tributaries of the river and assessed their storage potential. The studies on these projects show that 70970 million cu m (cubic metres) of live storage capacity is available against the total average annual yield of 494300 million cu m of the Brahmaputra at Pandu, which is about 14.4%. While the reservoirs on the Siang (Dihang) and on major tributaries like the Subansiri, Dibang, Lohit and Jiabharali would contribute substantially to a reduction of flood peaks in the main river, the tributaries like the Pagaladia, Puthimari, Duri Dihing, Desang, Dikhow, Jhanzi, Dhansiri(s) will have storage to control flooding in their own valleys. The total live storage of these reservoirs is shown in Table 3.

TABLE 3

Rivers	*Run-off mham*	*Live storage mham*
Noa-Dihing, Desang, Dikhow, Jhanji, Dhansiri, Kapili, Kulsi	2.168	0.466
Dihang (Siang)	17.90	3.55
Lohit	3.70	0.331
Dibang	3.39	0.47
Subansiri	5.27	1.00
Jia-Bharali	2.59	0.51
Pagaldiya	0.10	0.01
Puthimari	0.25	0.04
Manas	3.82	0.72
Total	39.188	7.097

Alongside the preparation of a master plan, the Board is also engaged in detailed investigation of important projects identified in the master plan. The important dam projects under investigation are Dihang, Subansiri, Lohit, Dibang, Jia Bharali, Pagaladiya and the Tipaimukh dam projects. The status of these projects is as follows:

Dihang and Subansiri Dam Project: Detailed investigation of these two projects was completed by the Brahmaputra Board and reports submitted to the GOI in July 1983. The projects are under scrutiny by the CWC and CEA. These two projects are important components of the master plan of the main Brahmaputra prepared by the Board. It may be indicated here that the Government of Arunachal Pradesh has expressed serious reservation about the implementation of these two projects.

The Dihang dam project envisages construction of a 297 m high rock fill dam at Retung village, 40 km upstream of Pasighat town in Arunachal Pradesh. The reservoir will have a spread of 490 sq km. The project will have a live storage capacity of 3.55 mha m and will provide large benefit of flood moderation, hydropower generation, navigation, irrigation and so on. The installed capacity of the project is 20,000 mw (megawatts). The firm power to be generated is 5710 mw on a 90% dependable basis. The project is estimated to cost Rs 12,170 crore at 1988 prices and will take 13 years to complete. The cost of power generation works out to 27 paise per unit.

The study made by CW and PRS, Pune indicates that the flood height at Pandu would be lowered by a range of 1.75 m to 0.60 m with the Dihang dam alone in position. If the Subansiri dam is added, the reduction range would come to 2.15 m to 0.75 m at Pandu. So far as flood moderation is concerned, the proposed storage reservoir will provide full flood protection not only in the Siang valley but also a reasonable lowering of flood stages in the downstream reaches of the main Brahmaputra.

But this proposal could not make much headway because of the reservations of the Government of Arunachal Pradesh regarding the large submergence of the two townships, Along and Yingkiong.

The new proposal prepared by the Brahmaputra Board after studying the topography and the geological conditions consists of (*i*) a 257 m high rockfill dam on the Siang, 14.5 km upstream of Yinkiong, (*ii*) a 154 m high rockfill dam on the Siyom river, 15 km upstream of Kaying, and (*iii*) a 65 m high concrete dam on the Siang, 37 km upstream of Pasighat near Rotung village.

The highlights of the new proposal and the original proposal are highlighted in Table 4.

Since the new proposal is at an initial stage, detailed investigations

have not yet begun. Only the locations of the three new dam sites have been finalised with preliminary assessments by the Board. They indicate that in comparison to the original proposal, the flood moderation component will be considerably reduced in the Brahmaputra valley. As far as the interest of the north eastern region, particularly Assam, are concerned, flood moderation in the Brahmaputra valley is a prime factor. So the new proposal should ensure the flood moderation component in the formulation of the project.

The Subansiri dam project envisages construction of a 257 m high rock-fill dam at the Assam-Arunachal Pradesh border near Gorukamukh. The reservoir will have a spread of 193 sq km. The live storage capacity of the reservoir is 1 mha m and will provide flood control benefit in the Subansiri sub-basin. Besides flood control the project will produce substantial hydro-electric power. The installed capacity is 4,800 mw with firm power to be generated at 1789 mw on a 90% dependable basis. The estimated cost of the project is Rs 4,200 crore at 1988 prices. The cost of power generation works out to 24 paise at 1988 prices. The project will take 10 years to complete.

TABLE 4

Particulars	*New proposal*				*Original*
	Dam site I	*Dam site II*	*Dam site III*	*Total*	*proposal*
Location	14.5 km U/S Yinkiong	15 km U/S of Kaying	37 km U/S Pasighat	—	37 km U/S of Pasighat
Dam height	257 m	154 m	65 m	—	69 m
Type	Rock-fill	Rock-fill	Concrete	—	Rock-fill
Cost (Rs cr.)	17,810	2,003	3,607	23,420	12,170 (1988)
Firm power	3,287	214	1,040	4541	5710 mw
Installed capacity	11,000 mw	700 mw	1,700 mw	13400 mw	20,000 mw
Cost of generation	(Rs) 0.76 kwh	1.31 kwh	0.54 kwh	—	0.27 kwh
Submerged area	94.18 sq km	10.5 sq km	75 sq km	179.68 sq km	490 sq km
Township	Nil	Nil	Nil	Nil	Two

TABLE 5

Particulars	*New proposal*				*Original*
	Dam site I	*Dam site II*	*Dam site III*	*Total*	*proposal*
Location	U/S of Monga Confluence	3.5 km U/S of Tamon	2.3 km U/S Gorukamukh	—	2.3 km U/S of Gorukamukh
Dam height (M)	265	213	116	—	240 m
Type	Rock-fill	Rock-fill	Rock-fill	—	Rock-fill
Cost (Rs cr.)	6575	4.660	1.960	13195	4.200 (1988)
Firm power (mw)	885	692	951	2528	1789
Installed (mw) capacity	2500	2000	2800	7300	4,800
Submergence area (sq km)	60	57	37	172	193 (sq km)
Township submergence	Nil	Nil	Nil	Nil	Three

The proposed storage reservoir will provide full flood protection, not only in its own valley but also a reasonable lowering of flood height in the downstream reaches of the Brahmaputra. The study made by CW and PRS, Pune indicates that the flood height at Pandu will be lowered by a range of 0.60 m to 0.30 m with the Subansiri dam alone in position. If the Dehang dam is added, the reduction range would come to 2.15-0.75 m at Pandu.

But this proposal did not make much headway because of the reservations of the Government of Arunachal Pradesh regarding the submergence of the townships of Daporijo, Dumporijo and Tamon.

The new proposal framed by the Brahmaputra Board after studying the topography and the geological conditions consists of (*i*) a 265 m high dam on the Subansiri upstream of Daporijo, (*ii*) a 213 m high dam on the Kamala river upstream of Tamon, and (*iii*) a 116 m high dam on the Subansiri 2.3 km upstream of Gorukamukh. (Table 5)

The new proposal is at an initial stage; detailed investigations have not yet been started. Only the locations of the three new dam sites have been finalised with preliminary assessments by the Brahmaputra Board.

The preliminary assessment indicates that the flood moderation component will not be significantly reduced in the Brahmaputra valley in comparison to the original proposal. For the North East region, particularly Assam, flood moderation in the Brahmaputra valley is a prime factor. So the new proposal should ensure the flood moderation component during formulation of the project for an effective and reasonable permanent solution to the flood problem in the two valleys, besides hydropower generation.

The following table indicates the viability of the Siang (Dehang) and the Subansiri multipurpose projects in the North East. (Table 6)

The Pagladiya dam project envisages construction of 26.20 m high and 23 km long rolled earth-fill dam near Thalkuchi village, about 26 km upstream of Nalbari town. The reservoir created by the proposed dam will be 3706 hectare to create live storage of 278 m cum. The gross command area for irrigation will be 54,160 ha; 1.5 mw of firm power, with an installed capacity of 3.0 mw, is also proposed to be generated through irrigation canal release. The estimated cost of the project at 1995-96 prices amounts to Rs 479.21 crore and it will take seven years to complete. The annual benefits that will occur from the project are, flood control (Rs 14.00 crore), irrigation (Rs 71.17 crore), and power (Rs 1.98 crore).

The project has been cleared by the Ministry of Water Resources, the Ministry of Environment and Forest, and the Ministry of Welfare. The project is entirely within the state of Assam.

The Tipaimukh dam project envisages construction of a 162.5 m high rock-fill dam across river Barak at Tipaimukh, which is situated on the border of Manipur, Mizoram and Assam. The live storage capacity of the reservoir is to be1.59 mha m. Its installed capacity is 1500 mw with a firm generation of 1000 mw. It will ensure flood moderation in the entire Barak valley downstream. The cost of the project is Rs 2899 crore. Though the project has been cleared by the Ministry of Water Resources as well as by the Ministry of Welfare it is still under consideration by the Ministry of Environment and Forest, Government of India.

The Lohit dam project envisages construction of a 296 m high rock-fill dam with installed capacity of 3300 mw. Live storage will be around 0.33 mha m. The project will provide flood moderation not only in its own valley but also a reasonable lowering of flood height in the downstream reaches of the Brahmaputra.

The other promising projects with attractive storage capacities for flood moderation as well as power generation already identified by the Brahmaputra Board are Dibang, Kameng, Lohit. They will make a considerable contribution towards mitigating the flood problem in the North East and are currently either in the detailed investigation stage or in preparation of project reports stage under the Brahmaputra Board.

The Brahmaputra Board has so far finalised the Pagladiya dam project and the Tipaimukh dam project; alternate proposals for the Siang (Dihang) dam project and the Subansiri dam project are under investigation. However, the cost of the two projects has been highlighted by the Board. The cost of these projects, as projected by the Brahmaputra Board is as follows: The Pagladiya dam project Rs 480 crore, Subansiri dam project Rs 12500 crore, Dehang dam project Rs 23444 crore, and Tipaimukh dam project Rs 2899 crore, amounting to a total of Rs 39323 crore.

To tackle the problem of flood, drainage congestion and so on, the Government of Assam has constructed about 4448 km of embankments, 846 km drainage channels, 77 major sluices and 60 bank and town protection works as temporary short-term measures and they have served the desired purpose. But with the passage of time and changes taking place in the meandering pattern of rivers, these protection measures have failed to assure the necessary protection to the people and to their properties.

The problem needs our immediate attention. The construction of proposed storage reservoir projects is the only solution in sight, as suggested by experts from time to time.

Implementation of the Subansiri projects, with the original project proposals, would have provided full flood protection not only in the main basin but also reasonably lowered flood stages in the downstream reaches of the Brahmaputra. But given the reservations of the government of Arunachal Pradesh, this project proposal had to be modified. New project proposals with three dams sites have now been proposed by the Brahmaputra Board in consultation with the Government of Arunachal Pradesh.

The new proposals have not yet confirmed flood moderation. However, this project may go through given its proximity to the plains, and lenient view of the Arunachal government. It may be initiated as a pilot project which, apart from its own assured benefits, may facilitate taking up of other projects in the region.

The long term measures of constructing reservoirs, if taken up, would involve considerable time. Hence it is necessary to initiate immediate steps for improving the existing measures for protection in Assam.

TABLE 6

Name of the Project	*Installed capacity (mw)*	*Cost of the project (Rs cr.)*	*Cost per kw of installed capacity (Rs)*	*Cost per kwh (paise)*
Sardar Sarovar, 1981	1450	4,240.00	7,450	35.00
Narmada Sagar, 1983	1000	1,392.85	8,390	46.20
Tohri, 1979	1000	481.30	4,813	17.69
Base project (Pong Dam), 1966	240	276.08	5,079	—
Dehang, 1995	13400	23420.00	—	71.00
Subansiri, 1995	7300	13195.00	—	60.00

Some disturbing questions

R. RANGACHARI

FLOOD devastation has become a recurrent and debilitating annual feature in our country. After India's independence, the severe floods of 1954 focused attention on the inadequacy of the measures taken till then and a National Flood Control Policy was announced for the first time. A planned programme of flood control was launched the same year. The main emphasis since then has been on construction of embankments and incorporation of flood control as one element in some of the multipurpose reservoirs (like Hirakud, Bhakra and Ukai). Drainage improvement works were also implemented – mostly in Punjab, Haryana and West Bengal.

Despite the 'huge investments' on various planned measures in the last 50 years, the flood-affected area seems to be ever on the increase. Destruction of infrastructure, damage to crops, loss of lives, human and cattle, collapse of dwellings have been on the rise.

This perceived asymmetry between expenditure on flood protection measures and increasing flood damage raises several legitimate questions. Is flood control possible and are the types of measures undertaken the best possible response to floods? What has gone wrong with our apparently sincere efforts on flood management?

Areas generally get flooded due to intense rainfall spells, heavy onrush of water from upstream, backing up of waters in tributaries at their outfalls, and/or synchronisation of upland floods with high tides. Cyclones also cause intense rainfall and extensive damage on account of strong winds. It is not possible to isolate the flooding due to river spill, drainage congestion and cyclonic storms.

The average annual rainfall in India is around 115 cm but with significant variations in its spatial and temporal distribution. The south-west monsoon is the principal rainy season accounting for over 80% of the annual rainfall and most floods occur during this period, generally between June and October. It is also worth recalling that some of the world's wettest places are in India. Almost all rivers carry a heavy discharge during the monsoon. The problem of floods varies from basin to basin and year to year but the most flood-prone areas lie in the Brahmaputra basin and the northern sub-basins of the Ganga.

The extent of annual damage due to floods and drainage congestion

is reported by the state governments. At the national level, the Central Water Commission compiles these records from time to time. From the statistics so compiled, available since 1953, the general average picture of flood affected areas and flood damage can be gleaned from Table 1.

On an average, each year around 8 million ha (mha) get affected, of which 3.5 mha are cropped area. 32 million people are affected; around 1500 human lives and nearly 97,000 cattle are lost. The average value of damage to houses, crops and public utilities alone is reported to be around Rs 982 crore.

However, the figures vary from year to year, and in the years of severe damage (such as 1988 or 1978) the loss is many times the average figures. The 1978 flood affected 17.5 mha of which a little less than 10 mha was cropped land. More than 3.5 million houses were damaged. The 1988 flood affected 16 mha but the cropped area affected that year was 10.15 mha, the highest so far. The value of total damage was indicated at Rs 4630 crore. The loss of human lives was the highest in 1977 indicated at 11316 people.

TABLE 1

Flood Affected Areas and Flood Damage in India
(Selected abstract for the period 1953-1994)

Item	*Unit*	*Average for the period 1953-1994*	*Maximum in any one year (with year)*
Area affected	Million ha	7.56	17.5 (1978)
Cropped area affected	Million ha	3.53	10.15 (1988)
Population affected	Million	32.0	70.45 (1978)
Lives lost human	Numbers	1504	11316 (1977)
Lives lost cattle	Numbers	96713	618248 (1979)
Houses damaged	Million	1.17	3.51 (1978)
Value of damage to houses, crops and public utilities	Rs crore	982.1	4630.3 (1988)

Source: Central Water Commission.

There are some deficiencies in the manner of reporting, cross checking and presentation of statistics by state governments, and many suggestions for improved and correct reporting have been made. Often, motives are imputed for slanted reporting of figures and these cannot all be considered as unjustified. Notwithstanding all this, the figures as reported are indeed appalling.

Since 1954 a number of committees have reviewed flood control. In 1976 the Government of India appointed the Rashtriya Barh Ayog – RBA – National Commission on Floods inter alia, to review the measures undertaken since 1954, analyse the damage caused by floods in recent years and evolve a comprehensive approach to the problem, keeping in view optimum and multipurpose utilisation of water resources.

The RBA in its 1980 report made some 207 recommendations covering the entire gamut of flood management activities. These were examined by the GOI in consultation with state governments and as a result, further actions to be taken for implementing the recommendations (suitably modified or amended where necessary) were circulated to all states/ministries in September 1981. A review of the implementation, made by the Central Water Commission (CWC) in 1987, indicated that hardly any of the recommendations were followed up. The position remains almost the same even today.

The floods of 1987 and 1988 were severe in Bihar, West Bengal, U.P. and Orissa, as also in Assam and the other north-eastern states. The Central government set up two committees, one for the north-eastern region and the other for the states of Bihar, West Bengal, U.P. and Orissa, with Central and state government participation, to review the flood management position. The reports were released in December 1988. They reiterated the continued relevance of the RBA recommendations while making other suggestions. These reports too, by and large, remain confined to the files of the concerned state governments and central agencies.

It will not be possible to examine the various facets of 'flood management' in India or go into all the necessary details within this brief article, but some of the many relevant issues and questions posed are briefly examined here.

Is the extent of area liable to floods or the actual flood affected area in India increasing? The practice followed is to assume that the summation of the 'maximum area damaged in any one of the years' in each state as the 'area liable to floods' in the country. Based on this criteria and using the statistics for the period 1953 to 1978, the National Flood Commission (1980) indicated the figure as 34 mha. However, the annual flooding is not geographically coextensive as different areas may be and are often flooded in different years from different rivers.

We have since then about 20 years data to see if the area liable to floods has increased. Since 1978 to date only Assam-Meghalaya reported the area affected as higher than earlier. It would thus appear reasonable to conclude that the area liable to flood has not increased after the RBA report.

The statistics of the last 25 years (1970-1994) compiled by the Central Water Commission relating to areas in India affected by floods from year to year, population affected and lives lost

all indicate that since 1978 there has neither been an increase in the area affected nor in number of lives lost. In fact, the figures have declined since then, except for 1988.

Are damages due to flood on the increase? The total damage to crops, houses and public utilities has maintained a rising trend. The 1988 floods reportedly caused greater damage than the 1978 floods, the figure for 1988 being Rs 4630 crore against Rs 1455 crore for 1978. Even if we consider the damage in terms of constant 1981-82 prices, the figure for 1988 is one-third higher than that for 1978.

Some of the factors responsible for the increasing trend of flood damages could be: (*i*) increasing indiscriminate encroachment into the flood plains; (*ii*) increased agriculture productivity; (*iii*) increased private and public investments in flood plains; (*iv*) rise in price levels; and (*v*) some possible inflated damage statistics (for obtaining greater relief assistance).

Since the beginning of planned development in 1951, under successive five year/annual plans, outlays for flood management works have been largely made by the state governments (see Table 2). However, in relation to the extent of flood damage occurring from time to time, the planned outlays cannot be considered as adequate or well spent to achieve the purpose in view. Less than one per cent of total plan expenditure is spent on flood management works and, sad to say, the figure has progressively come down since 1980.

If the outlays on planned flood management measures are meagre, is it not part of our general problem? Is it the general constraint of available finance that has limited the outlay on planned flood management works to a pittance so far? It would appear not because the government is in general spending more money on unplanned flood relief expenditure than on planned amelioration measures as can be seen from corresponding figures available for some blocks in recent years (see Table 3 above).

The logic of a low outlay through planned measures, while a larger expenditure is regularly incurred on unplanned relief, is not clear. This is particularly so if we keep in view that the likely economic improvement in any sector is prone to be washed out by the periodic flood disasters. Meanwhile, master plans for flood management in the Ganga and Brahmaputra basins have been made and recast many times but these remain unimplemented either for want of decisions or funds.

Is flood control possible at all? The expression 'flood control' is a misnomer. It is well understood that absolute protection cannot be provided to all areas for all types of floods at an economic cost. The same degree of protection need not even be necessary. What is really needed is flood management. This is a broad-based term which includes planned engineering and other measures aimed at not only moderating the flood but also enabling optimum utilisation of surplus water to meet the needs; wise application of engineering and social sciences has afforded ways of mitigating the ravage due to floods and providing reasonable measure for

TABLE 3

Planned Outlays on Flood Management vs. Flood Relief

Plan	*Period*	*Total outlay in planned flood management works (Centre + state) Rs crores*	*Central assistance to states for flood/ cyclone relief Rs crores*
VI Plan	1980-85	786.8	838.3
Part of VII plan	1985-1988 (3 years)	552.9	828.1
Part of VIII plan	1992-1996 (4 years)	1220.5	2816.7

Source: Compiled from different sources believed to be correct.

TABLE 2

Total Outlays for Flood Management in Successive Plans

Plan	*Period*	*Total plan expenditure in all sectors Rs crore*	*Outlay on flood management Rs crore*	*Percentage*	*Total plan outlays for flood management in Rs crore, expressed in terms of constant value of Rs at '96-97 prices*
I	1951-56	1960	13.2	0.67	274
II	1956-61	4672	48.1	1.03	761
III	1961-66	8577	82.1	0.96	551
	1966-69	6625	42.0	0.63	585
IV	1969-74	15779	162.0	1.03	1040
V.	1974-78	28653	298.6	1.04	1486
	1978-80	22950	329.6	1.44	1286
VI	1980-85	109292	786.8	0.72	2096
VII	1985-90	218730	941.6	0.43	1798
	1990-92	123120	460.4	0.37	686
VIII	1992-97	434100	1691.7	0.39	2495
TTL.	1951-97	974458	4856.5	0.498	12222

Source: Planning Commission/Central Water Commission.

protection of life and property.

Structural measures would include reservoirs (flood control or multipurpose), detention basins, embankments, channel improvement, floodways and drainage improvement. It is also recognised that non-structural measures like flood forecasting and warning, flood plain management and so on considerably help reduce, if not avoid, loss of lives and property.

Have the structural measures undertaken so far been of any help in flood management? India has built over 3300 large dams since 1951 (including some 700 still under construction). However, out of these only the four reservoirs of the DVC system (and at best one or two more of which details are not available) were planned with a dedicated 'flood reserve' for flood control purposes. In the others, storage space could be used for flood storage when possible, but sometimes the operation of the reservoir could create a situation of increased flooding lower down as well.

So the only case history of storage reservoirs with an allocated flood reserve relates to the DVC system. The DVC reservoirs have in fact helped alleviate the intensity of floods lower down, as is evident from the way they handled peak flows during the high floods from 1960 to 1988, the period for which details are available (Table 4).

The Damodar Valley Corporation (DVC) was established in 1948 on the pattern of the Tennessee Valley Authority of the U.S. Its statutory functions, inter alia, include the 'promotion and operation of schemes for flood control in the Damodar River and its tributaries.' The Damodar is a shallow, wide and flashy river. The entire left bank is protected by an embankment. The river has a long history of floods. As per data at Rhondia (Anderson weir), since 1901 a flood discharge of the order of 18400 cumec (6.5 lakh cusec) had been reached. Voorduin of TVA whose advice was sought, proposed a plan which involved creating storage reservoirs upstream for multiple benefits, including a specific flood reserve.

It was considered that a design flood of the order of 28320 cumec (1 million cusec) was likely till 15 August, while it could go down to 21200 cumec (7.5 lakh cusec) after that date, as per normal rainfall pattern. The Damodar river below Durgapur was indicated to be capable of safely passing 7079 cumec (2.5 lakh cusec).

The Unified Development Plan proposed seven reservoirs with a 3.58 billion cubic meters (BCM) controlled flood reserve and a 0.61 BCM uncontrolled flood cushion. Since then there has been a progressive whittling down of the scope of the plan. First, only the implementation of phase I comprising the Tilaya, Konar, Maithan and Panchet dams was approved apart from the Durgapur barrage, canal and irrigation system. This reduced the flood reserve from 3.58 to 1.86 BCM. Even this could not be realised in practice as the necessary lands were not acquired till the top of the gates. This reduced the available flood cushion further to 1.28 BCM.

Later, the Tenughat dam was approved outside the DVC and more importantly the flood reserve at this reservoir site was abandoned. By an inter-state agreement between Bihar and West Bengal in July 1978 even the small flood reserve available at Tilaya and Konar was abandoned for conservation storage. This agreement, however, provided for the acquisition of the remaining reservoir land within Panchet and Maithan, primarily for flood moderation.

A committee with Member (floods) CWC as Chairman, in a report submitted in May 1986, had made several recommendations that dealt with flood management in the Damodar. No details of any follow-up action on this report are available. There is a constant pressure to encroach *even further* into the presently available flood reserve (1.05 BCM) in Maithan and Panchet. Unless a dedicated flood reserve of the required order and strict

TABLE 4

Flood Moderation Made Possible by DVC Reservoirs
(In case of floods from 1961 to 1988 for which details are available)

Year	*Dates of peak flood spell*	*Combined Inflow*		*Combined Outflow*		*Discharge at Durgapur*	
		Cumec	*1000 Cumec*	*Cumec*	*1000 Cumec*	*Cumec*	*1000 Cumec*
1978	26/27 September	21917	774	4615	163	10760	380
1973	12/13 October	16650	588	4955	175	5748	203
1961	02/03 October	14611	516	4569	160	5521	195
1963	24/25 October	13167	464	2577	91	3454	122
1971	16/18 July	12006	422	5097	180	6286	222
1965	29/30 July	10562	373	2209	78	2746	97
1975	25/27 September	9741	344	3114	111	4474	158
1980	27/30 August	9656	341	4219	149	NA	
1976	17/20 September	8410	297	4615	163	5663	200
1970	03/06 September	8268	292	2883	100	NA	
1977	28/30 July	8211	291	2888	102	NA	
1984	23/27 June	7815	276	2973	105		

Source: Compiled from Central Water Commission records (unpublished).

reservoir regulation laying down the operational procedures and independent monitoring of the regulation is ensured, reservoirs cannot offer requisite flood management benefits.

The moderation of the design flood to 2.5 lakh cusec by itself will not be sufficient to tackle the problem of floods in the lower Damodar area because of inadequate drainage capacity. The carrying capacity at lower reaches of the river below Begunia was around 1614 cumec (50,000 cusec). In addition there is the problem of flooding of the land on the right bank from the waters of the neighbouring rivers like Dwarkeswar, Silai and Kasai. Hence, flood relief in lower Damodar is dependent upon additional measures than DVC dams.

The RBA in a special case study of the Damodar found that 'the dams have been able to moderate floods to the extent designed. The lower Damodar, however, is not capable of carrying the originally planned discharge of 7080 cumec (2.5 lakh cusec).'

In multipurpose reservoirs the interests of the various components like irrigation, hydropower generation and flood control are usually at variance with one another even when the reservoir is owned/operated by a single state/authority. This conflict becomes pronounced when more states/agencies are involved. Multipurpose reservoirs imply a compromise, and flood moderation usually gets neglected, unless a specific flood space is earmarked. Most of the complaints voiced about the reservoirs, including the aggravation of floods lower down, is a result of this position.

What about our experience with embankments? As a measures of protection against flood spills, embankments have been extensively built largely near important towns, habitations and valuable developmental works. This was so possibly because they could be easily constructed with local labour and materials in comparatively short periods. There are, however, many problems associated with embankments. Unfortunately there are few scientific evaluations of their actual performance under different types of rivers in representative regions. Even the RBA when examining the efficacy of embankments argued that though 'embankments properly designed, constructed and maintained afford protection to large areas, deficiencies in any of these prerequisites could lead to damage.' It asked for a scientific evaluation and recommended that in planning embankments as part of flood management programmes, the associated problems and side-effects be kept in view and minimised to the extent possible.

Even after two decades of the establishment of the RBA, we have no scientific evaluations available on embankments. Notwithstanding increasing criticism from the stakeholders living in the area, construction of embankments continued in many states. There is need for not only a review but also an open debate on all the relevant issues so that people are involved in decision-making based on concrete facts and information.

As of 1993 the total length of embankments in India had risen to 16200 km with two-thirds thereof lying in just five states–Assam, Bihar, Uttar Pradesh, West Bengal and Orissa.

It is relevant to note that NGOs in these states have voiced strong criticism about the embankments that have been built. The serious breaches in the Kosi embankments among others, as also proposals for costly revetments, spurs and so on to protect the embankments, are all matters for serious consideration.

The indiscriminate construction of embankments, coupled with inadequate maintenance has created many problems, including severe drainage congestion, frequent breaches leading to greater distress and so on. Some people in 'protected areas' claim that while natural floods last only for a few days, 'man made' floods last months. The position that emerges is that embankments, as a part of flood management measures, are satisfactory only in suitable locations if properly designed, well executed and adequately maintained; these are big 'ifs'!

What about non-structural measures? Under the circumstances of limited funds, poor performance of structural measures and the inability of states to even adequately maintain what has been constructed, cannot due importance be given to non-structural measures to reduce flood damage? Non-structural measures like flood forecasting, flood plain management and disaster management, among others, could indeed offer great relief with or without structural measures.

Flood forecasting and warning systems run on inter-state rivers by the Central Water Commission have demonstrated their usefulness. However, the present coverage is inadequate and the supplementary work on warning measures by states is not satisfactory. The CWC network presently relates to 157 stations in India, two-thirds of which are in the Ganga-Brahmaputra-Meghna system. Every year some 6000 to 7000 flood forecasts are issued and these have been found to be accurate to the extent of 95%. Efforts to extend the coverage and even to improve their effectiveness have been hampered by the non provision of requisite financial resources, both under plan and non-plan heads.

The basic concept is to regulate land use by flood plain zoning. The RBA

recommended that flood plain management measures should be undertaken and suitable legislation enacted where necessary. A model bill for this purpose was also circulated in 1975. In order to enable demarcation of flood prone areas according to various flood frequencies, the Central government arranged for basic maps in 1:15000 scale through the Survey of India.

However, except for Manipur no other state has so far enacted the legislation. Even the demarcation of flood prone areas has still not been carried out by the states. Thus, progress with regard to flood plain management is poor. There seems to be a general reluctance by state governments in proceeding further with concrete steps, perhaps because of political difficulties. The relocation, time and again, after each flood, of the *jhuggi* clusters in river beds at public expense is an indication of this politics.

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Comments

A people's initiative

MORE than 1300 people dead, a total estimated loss of Rs 2,800 crore in as many as 55 districts – this was the result of floods (and landslides) during 1998 in Uttar Pradesh:[1] Perhaps this is just another set of figures for various government departments, another area of research for social scientists, demographers and engineers, a golden opportunity for traders, businessmen and local money-lenders to earn handsome profits. However, for the poorest of the poor, especially in some of the worst hit districts of Poorvanchal (eastern Uttar Pradesh) it virtually meant the end of everything – ambitions, expectations, beliefs and above all a zest for life.

Even the urban elite were not spared by this havoc. At its peak the Rapti, a major river of the region, was flowing at 85.82 metres on 21 August 1998 while Gorakhpur town (situated on its banks) is merely 78 metres above sea level. Just three days later, on 24 August, NH 28 and NH 29 (linking Gorakhpur to Lucknow and Varanasi respectively) suddenly breached at several places, virtually turning the city into an island, snapping water and electricity supplies for as long as five days. The damage was so severe that even with the best of efforts the authorities could not plug the breaches and resume traffic before October.

According to newspaper reports,[2] the rainfall in 1998 was three times the normal (no wonder the floods were so disastrous). The impact of submergence was so severe that certain areas remained waterlogged for one to three months. Out of a total of 1,579 villages in Gorakhpur, 1,187 were marooned,[3] which is 60% of all the flood-affected villages (1,965) in the four districts of Gorakhpur, Maharajganj, Deoria and Kushinagar engulfing an area of 2,35,831.72 hectares in these districts alone.[4] The number of deaths in Uttar Pradesh due to rains and floods was more than the number in Assam, Bihar and West Bengal put together.

The administration was ill-prepared for a disaster of such magnitude – additional boats had to be airlifted from Varanasi and Allahabad and the help of the armed forces sought to facilitate rescue and relief operations. Relief arrived from various quarters – individuals, traders associations, religious organisations, philanthropic organisations, big corporate houses and, of course, NGOs.

What happened to the deprived groups (destined to face such flood fury year after year due to gross neglect at the hands of policy planners, politicians and government functionaries during floods which ravaged almost the whole of U.P. in general and Poorvanchal in particular, twice in a short span of just one month), was nothing in comparison to their hardships after the floodwaters receded and everything apparently returned to normal. A visitor, unfamiliar with the topography and the nature of floods, would have happily concluded that everything was normal. But detailed discussions would unearth the tremendous hardships these marginalised members of the peasantry faced at that moment.

In an area where over 82.3% of landholdings are uneconomic (below one hectare), not less than 77.2%

1. *India Today*, 21 September 1998.
2. *Hindustan*, Lucknow, 12 July 1998.
3. *India Today*, 21 September 1998.
4. Remote Sensing Application Centre, U.P.: Radarsat Data, September 1998, Lucknow.

of total workers are engaged in agriculture[5] and 95% of dwellings are *jhuggies*, the severe plight of these people is hardly a surprise. Apart from crop loss, flood waters left behind a trail of destruction. Severe sand-casting on the once fertile agricultural fields, ranging from one to seven feet, cast a severe blow to the hazy expectations of recovery among these poor, marginal cultivators, eventually forcing them to migrate in search of employment. Just in Gorakhpur (one of the severely hit districts) sand-casting was witnessed in a total area of 11,253 hectares affecting 14,159 farmers in 148 villages.[6] During a visit to Brahmapur block of the same district in end-November 1998, the author could see nothing but sand all around.

A group of individuals concerned about the root causes of this disaster decided to facilitate formation of an Independent People's Commission on Floods in Eastern Uttar Pradesh, comprising experts on public health, sociology, agriculture, engineering, environment and voluntary initiatives.[7] Taking into account the paucity of time and resources, the members decided to focus on Gorakhpur and Deoria, the two worst affected districts. The idea was that these experienced individuals would not only help trace the genesis of floods of such magnitude but also analyse their impact on the lives of the poor, the efficacy of rescue and relief operations carried out by various institutions, and evaluate the appropriateness of technocentric flood control measures.

Basically, the commission drew extensive information from the ten large meetings organised with the civil society members – academicians, elected representatives, government officials, journalists and members of the affected community (women participated in large numbers in all such community meetings) around end-November 1998. The focus of the discussions was on future strategies for disaster mitigation and flood control. The schedule was hectic and since the floodwaters had just receded, certain villages could only be reached after long treks. Some members, in order to gather detailed first-hand accounts, also undertook additional visits co-ordinated by the local NGOs and other concerned individuals. Besides, a number of government documents and media reports were utilised. These processes finally culminated in the following observations/recommendations:

In a region where the ground slope is just 8-10 centimetres per km, even a one foot high road can easily impede the natural drainage over a vast area, as was witnessed during these floods. The numerous roads, rails and embankments have been unmindfully constructed by continuously compromising with established engineering principles leaving little scope for drainage – thanks to the role of constant local pulls and pressures aimed at satisfying parochial interests and the politician, contractor and bureaucrat nexus. The hardships faced by the residents of 104 villages falling in the Brahmapur and Rudrapur blocks of Gorakhpur and Deoria districts respectively, is a case in point.

These villages are located in a *doab* (land surrounded by rivers) between the Rapti and Gorra rivers. The latter, a spill-channel of the Rapti, emerges from a huge waterbody upstream and joins the main river just before the Rapti, in turn, merges into the Ghaghara. To 'protect' the residents, both the rivers are embanked on either side, thereby virtually turning the region into an island during peak floods. As if that was not enough, a road was constructed right across neatly dividing the villages of the two districts. This has further compounded the problems of the residents of Brahmapur block in the north.

All these rivers emerge from the Himalaya and since it is the newest mountain range in the world, they carry a lot of sediment downstream. In case of embanked rivers the same sediment gets deposited within the embankments leading, in course of time, to a raised river-bed, consequently creating a huge mismatch between the ground levels within and outside the embankments. This situation can be dangerous in the event of a breach in the embankments, directly causing terribly destructive flash floods outside.[8] Many of these vulnerable structures (embankments, roads and railways) have not been repaired for years.

1. State planners have repeatedly projected dams upstream around the Indo-Nepal border as the only long-term solution for flood control. The common people, struggling for survival on a daily basis, fail to understand the intricacies and apparently agree with these demands. Though these projects are promoted as multipurpose dams (simultaneously serving the dual purpose of electricity generation and flood control), rarely is it realised

5. Draft Plan, Department of Planning, Government of U.P., 1996.

6. District Agriculture Office, Gorakhpur, 1998.

7. The Commission comprised of Anand Kumar, Department of Sociology, JNU, New Delhi; Bhanu, NGO representative from Gorakhpur; C.C. Maji, former Director, National Centre for Agricultural Economics and Policy Research, New Delhi; D. Banerji, Professor Emeritus, JNU, New Delhi; D.K. Mishra, structural engineer and flood expert, Jamshedpur; and Himanshu Thakkar, engineer, New Delhi.

8. *Floods, Flood Plains and Environmental Myths – A Citizens' Report*, Centre for Science and Environment, New Delhi, 1991.

that these objectives have conflicting demands. While the former requires that maximum water should be stored in the reservoir, the latter demands that excess water should be constantly released. In the event of having to make a choice between the two, it is power generation that normally gets precedence.

It may be further noted that two such projects are currently high on the agenda of Indian and Nepali governments – the Karnali and Mahakali multipurpose dams. Here again the primary focus is power; irrigation and flood-control are subsidiary. It has been reported that MNCs like Snowy Mountain Engineering Corporation of Australia (SMEC) and Enron of USA have pushed these proposals.[9]

2. During the 1998 monsoon there were newspaper reports warning residents that more floods were imminent due to release of excess water by Nepal. This was, however, found to be entirely baseless simply because the two water control mechanisms in the form of barrages on Kosi and Gandak are controlled by the Irrigation Department of Bihar and hence the Nepalese authorities have no control over the process. Such rumours create further rift between the citizens of the two countries. Therefore, the People's Commission recommended that a joint international commission be urgently set up to sort out these issues through active participation from various stakeholders, especially the affected people.

3. A massive education programme needs to be launched to remove the false sense of security under which people normally live. They should clearly understand that flood control structures have a limited capacity to protect them from floods and hence cannot be blindly relied upon.

4. Paddy ranks foremost in eastern U.P. accounting for around 32% of cultivated area, followed by gram (15.97%), wheat (11.51%) and so on.[10] Since a large majority of people rely on agriculture for survival, the Commission felt that systematic long-term efforts should be made to facilitate the adoption of flood and waterlogging resistant varieties of rice and other crops as well. Moreover, it recommended that agriculture insurance mechanisms should be initiated for the poor cultivators.

Furthermore, the concerned authorities should ensure that seed banks are established under the aegis of gram panchayats so as to assist flood-affected farmers in rehabilitation. As mentioned before, though large land tracts have been sand-casted, the concerned have no clue as to what can be done; their biggest problem is that they have little experience of cropping in such conditions.[11]

5. It was a pleasant surprise that despite such devastating floods no major epidemic was witnessed in the region. Had it occurred, given the state of the existing public health services, the consequences can easily be imagined. The Commission observed that in the event of such disasters, public health interventions can succeed only if the services have been operating with normal efficiency in normal times, which was not evident in the flood-affected districts of the region. The Commission stated: 'Even when, say, half of the personnel are in position, and even when they work at half the expected level of efficiency, one can actualise some reasonable effective response to similar disasters – keeping stocks for emergencies, an information system, prevention, quick identification, immediate action for containment and control of possible epidemics and providing emergency medical relief to the affected.'[12]

6. The floods of 1998 once again proved that the local administration was completely unprepared for this calamity, otherwise the number of deaths at least could have been considerably reduced. In view of the hardship faced by the poor and the inadequacy of appropriate relief efforts, the Commission found it essential to recommend the setting up of a well-equipped Relief Management Centre with sufficient stocks of medicines, food and shelter materials in places like Gorakhpur and Deoria that had faced the maximum brunt.

7. Given the magnitude of the problem, the involvement of local self-government bodies and NGOs is of utmost importance in flood preparedness, rescue and relief operations, including public health interventions. This is not possible without adequate decentralisation of power, authority and resources to these institutions. NGOs, which had displayed exemplary courage and commitment in the recent floods, can also play a vital role in subsequent calamities. Subsequently, pancha-

9. Manisha Aryal, 'Dams: The Vocabulary of Protest', *Himal*, July-August 1995.

10. R.L. Singh, *India: A Regional Geography* (pp. 234-35).

11. Curiously enough, no sooner had the news regarding this calamity spread to neighbouring districts, many enterprising farmers especially from Ghazipur started trickling in, offering to take these holdings on lease with a view to cultivate bitter gourd, melons and so on (these require little irrigation and fertilisers but offer the scope of fairly good financial returns). Had the government facilitated capacity building of the affected farmers with the help of these enterprising cultivators, it would have gone a long way in reducing their hardships.

12. *Troubled Waters: A Report on the 1998 Floods in Eastern Uttar Pradesh*, The Independent People's Commission on Floods in Eastern U.P., Poorvanchal Gramin Vikas Sansthan, Gorakhpur, 1999.

yats should take over administration of Primary Health Centres (PHCs).

8. Construction of flood shelters of adequate size and appropriate design at strategic locations near the vulnerable villages should be seriously considered. Its cost, in the long run, would be low in comparison to that incurred on rescue operations.

9. The flood relief manual, a hangover of the colonial era, is outdated, and inadequate in the present context. Hence, there should be a participatory effort by the government for a thorough review of the manual, incorporating the needs, aspirations and accumulated wisdom of the people. Special provisions should be made in the manual for the most vulnerable sections and pregnant and lactating mothers.

10. The recommendations of the first National Flood Commission, which was set up in 1976 and submitted its report after four years, have yet to be implemented. Meanwhile, much water has flowed down the Ganges, Ghaghara, and Rapti. In other words new perspectives, experiences, information and understandings have emerged in the intervening period, which make it imperative for the government to set up a similar commission, offering a wider scope for various stakeholders, especially affected people and NGOs, to actively participate in its deliberations and to discuss the issues raised above more objectively.

11. Closely linked to the above is the question of transparency. The Commission has failed to understand as to why the various government institutions dealing with these aspects work under a garb of secrecy when our experience has repeatedly proved that programmes which do not seek active people's participation rarely succeed.

Sanjay Awasthi

Flooding corruption

IN 1974, the late Virbahadur Singh was a junior minister in the Congress government, desperately trying to chart out a route to reach the chief ministerial *gaddi*. An archetypal post-Partition politician, Singh did not have the sophistication or the guile of Hemvati Nandan Bahuguna or even a Narain Dutt Tewari. But he had other attributes. Endowed with native cunning and a flexible political morality that normally comes to grassroot politicians who have to struggle hard to gain attention in the Delhi *durbar*, Singh knew how political and geographical constituencies could be nursed and new support bases and vested interests created by effectively using government development funds.

He honed this understanding when the Rapti river breached the 76.84 metre mark in 1974 and its swirling waters began to inundate the periphery of his hometown, Gorakhpur. The devastation due to floods was extensive and there was a demand that the rampaging rivers (Rapti, Ghaghra, Rohini, Aami and Gandak are some of the rivers that torment this district) should be reined in. In those days embankments or *bunds* around the rivers were fashionable even though their efficacy had rarely been tested.

These floods carried important lessons for Virbahadur Singh. He knew that he could create a vested interest around his persona if he could kick-start the construction of embankments in Gorakhpur. Not only would it leaven his image as a 'development oriented politician', but it would also help him in controlling a burgeoning class of contractors who had till then subsisted on forest and road contracts. Money for running the business of politics too would be easy to come by. Virbahadur pushed hard for the construction of these bunds after he became the minister of irrigation. But before these projects could be put to stream and he could reap the harvest of his foresight, the Congress was voted out of power in 1977.

The work on these bunds really began during the time the Janata party was in power. So chaotic and anarchic was the manner in which the contracts were assigned that the embankments could barely rise a few inches off the ground. Once back in power, Virbahadur Singh came into his own. He restarted his pet irrigation projects and gave full expression to his thesis of contractor-driven development. A number of irrigation and PWD projects were thrown open to outside contractors. The earlier forest contractors, like Hari Shankar Tewari and Virendra Shahi, saw in these irrigation projects the promise of greater fortunes and political clout. Singh did not want the contracts to be bagged by those opposed to him. As chief minister he started anti-mafia operations in Gorakhpur, which were mostly directed against his *bete noire*, Hari Shankar Tewari. With the help of a group of greedy bureaucrats and political fixers he created a new class of contractors. Amar Singh, Mulayam Singh Yadav's present man Friday and power-broker of the nineties, earned his spurs in the company of Virbahadur Singh.

During the reign of Virbahadur Singh, corruption became a norm. Bureaucrats in cahoots with the contractors maintained a Nelson's eye on bunds coming up. Invariably there was gross overestimation of the

work actually accomplished. In many cases significant cost and time overruns weighed heavily on the exchequer. It is obvious that part of the government funds were routed through these contractors into the coffers of politicians and bureaucrats. Quality and commitment was given a go by.

As the criminal mafia bagged most of the contracts, no one had the courage to question the goings on and whether work was actually taking place. Inconvenient officers were shunted out and transferred to godforsaken places. Ever careful, Singh also kept the opposition leaders happy. Some of the high-priced government contracts went to the favourite contractors of top opposition leaders. The leader of the opposition in those days, Mulayam Singh Yadav, was kept in check through this devise. In most cases the quality of these projects (like the bunds) was a casualty.

During this period about 400 km of mud bunds were constructed along the various rivers that flow down from neighbouring Nepal. On a rough estimate, these embankments cost the government about Rs 1000 crore, the bulk of money getting siphoned out by the venal nexus. Increased affluence of the criminal mafia and their political patrons helped in redefining politics.

This model of politics and governance, successfully replicated during different times by different political regimes, had disastrous implications for the economy and environment. The infrastructure so created at different levels by such venal regimes has been so shoddy that it gives an impression that a disaster is waiting to happen. The political and bureaucratic leadership spawned by such social and political forces is so amoral and corrupt that it tries to use human tragedy as opportunity for self-aggrandizement.

This sketchy effort to trace the contemporary history of Uttar Pradesh helps to understand the catastrophe that struck Gorakhpur last year. Around August-September, the rivers in this region displayed uncharacteristic violence to kill more than 1,500 people and sweep away millions of houses. By government estimates, 57 bunds in eastern Uttar Pradesh were breached by the gushing waters of the Rapti, Ghaghara and other small rivers. A majority of these embankments gave way to the fast moving rivers as they were badly maintained and did not conform to the stipulated height necessary to keep the mercurial waters in check. Interestingly, all these bunds had been shown as 'maintained' in the irrigation department files and colossal amount of monies used for this purpose.

The *modus operandi* adopted by the contractors to maintain the bunds is quite simple. The contractors normally do not begin work till the end of May or June, when the monsoon is round the corner. They perform their job in a perfunctory manner and polish off the entire tender amount, leaving the bund to the mercy of God. According to a former M.P. of Gorakhpur, Harikesh Bahadur, 'Some of the bunds are not more than three to four feet in height but they have been shown to be ten feet tall.' It is bunds like these that exponentially multiplied the fury of the floods. A report from Lucknow in *Jansatta* categorically states that 'the majority of the population has been affected by floods due to the collapse of dams.' The report further asserts that bureaucratic indifference and callousness exacerbated the floods.

The BJP government, which has a fair share of ministers who consider the late Virbahadur Singh as a role model, found itself pulled in different directions. On the one hand was the motive of individual ministers to use this tragedy for greasing their pockets. On the other was the organizational and constitutional compulsion to perform in times of human tragedies. Like always, personal interest triumphed and the more enterprising BJP ministers began to devise ways to corner relief meant for those braving the stench of the stagnant water. Contracts for supply of food packets for flood victims based in Gorakhpur were given to favourites in Benares. At inflated cost, these rotten food packets were delivered to people looking for succour. So outraged was the harassed population that it chased out these BJP leader. For a couple of weeks, no BJP leader dared to visit Gorakhpur.

The 1998 floods ravaged 55 districts and about 15340 villages. 1,500 people died[1] and 80,000 houses were destroyed. It also breached the national highway 28 and 29. Ironically, these floods also inundated those areas of Gorakhpur where the *nouveau riche* class of contractors has built its farmhouses. The total loss due to floods, according to government estimates, was Rs 3536 crore.[2] This by most accounts is a grossly conservative estimate. The Uttar Pradesh government demanded Rs 2000 crore for flood prevention involving the creation and beefing up of bunds. One does not have to stretch one's imagination to know how these funds would spawn bad money and equally bad politics. Can India survive such a development path that perpetuates criminality and corruption and provide a fertile ground for man-made catastrophes?

Sanjay Kapoor

1. *Jansatta*, 4 October 1998.
2. *The Hindustan Times*, 10 September 1998.

Books

SILENCED RIVERS: The Ecology and Politics of Large Dams by Patrick McCully. Orient Longman, Hyderabad, 1998.

AMONG the few but growing number of books on the ecology and politics of large dams, this book will for long stand out for its comprehensive and objective treatment of the subject. Though Patrick McCully, the author and campaigns director of the International Rivers Network is clearly critical of large dams on many counts, he strives not to strike an anti large dam position. His aim, as stated at the beginning of the epilogue of this *magnum opus*, is something no one can take exception to: to bring democracy in the functioning of the dam industry. 'Bringing the dam industry under democratic control will remove a major threat to the integrity of riverine ecosystems and human communities.' Throughout the 400 odd pages and ten chapters of this book, he narrates with authority and in detail the implications of undemocratic functioning of the dam industry.

The book begins with the history of evolution of large dams over the last 60 years. More than 85% of the over 40,000 large dams obstructing rivers all over the world were built in the last 60 years since the inauguration of the Hoover dam by U.S. President Roosevelt in 1935. However, that steep graph is now flattening out, and not only because the most favourable sites for construction of large dams are getting exhausted. This is also because it is becoming more difficult to support a large dam project in any country where democratic and hence transparent functioning is a norm.

It is noteworthy that despite of all the scientific developments, even as we prepare to enter the 3rd millennium, we still do not know how we can fulfil our needs without killing our rivers, the birthplaces and life supports for all civilisations. Even as late as March 1999, an international hydropower conference in the U.S. noted that we have still to understand and quantify the flow requirements in the rivers to meet social and ecological needs and to keep them alive. Similarly, despite all talk of development, we are still unable to develop basic, humane resettlement and rehabilitation policies and practices for the people whose sacrifice is demanded in the name of public purpose called large dams. As the secretary to India's Rural Areas and Employment Ministry accepted in a meeting in February 1999, more than 50 million people have been displaced in India since Independence, over 80% of them due to large dams. More than 80% of them have not been helped to resettle. It must be noted here that the estimate of between 30 and 60 million as displaced due to large dams all over the world seems a gross underestimate. Thus, as chapters two and three of the book detail, environmental and social consequences of large dams provide the main planks for criticizing large dams.

But that is not all. Other chapters of the book critique those aspects of large dams where the dam builders believe they are on firmer grounds: technical aspects and benefit. This review is not the right place to describe how dams have increased rather than decreased damage due to floods, how they have made millions of hectares of land uncultivable due to water-logging and salination as dam builders refused to include basic drainage designs into large irrigation projects and, most importantly, how they have failed to provide the promised benefits and how their actual costs have turned out to be higher than those projected.

It is indeed a telling comment that the 'dam industry has never carried out a comprehensive retrospective assessment of the ecological, economic and social effects of a representative sample of large dams or even of a single project.' This was attempted for the first time in 1996 by the World Bank which, even

today, is the single largest funder of large dams the world over. The review was so biased and worthless and generated such strong criticism that it ultimately led to the setting up of the World Commission on Dams in early 1998, 'to assess development effectiveness of large dams and alternatives.' The setting up of this independent commission to submit its report by June 2000 has itself put the biggest question mark over large dams as development propositions.

Besides providing a strong critique of large dams, the book discusses available and credible alternatives for meeting the needs of food, water, flood management and power. The logic of the alternatives lies in the very nature of river basins and watersheds. If the water and its power is harvested where it is first available, then not only do large dams become unnecessary, but justifiable needs of water and power can be satisfied without any of the ill-effects of large dams.

The most significant contribution of the book is of course its exposition of decommissioning. Even as U.S. interior secretary Bruce Babbit went around decommissioning dams with these prophetic words in August 1998, 'The clang of the sledge hammer is one of the oldest sounds known to man. Yet now, at the end of the 20th century, we are using it to ring in an entirely new era,' he was only emphasising what McCully had already described. As the average age of existing dams across the world rises and the structures become weak, dilapidated, difficult to maintain and as they get filled with silt instead of water, the question of what to do with them will arise with increasing seriousness. And yet, the dam builders have still to include the cost of decommissioning a dam in the cost-benefit analysis of dams now being built. And these costs could be more than building the dams. As McCully records, the president of the International Commission on Large Dams noted in 1992, 'I have only once seen a paper on decommissioning of dams.'

Notwithstanding all the adverse consequences of large dams and the increasing resistance that large dams continue to face all round the world, unfortunately, they continue to be built with all their undemocratic baggage. However, the one bright spot is that most large dams are built in countries which are not under democratic rule or in countries where it is still possible to suspend democracy for such projects. This trend provides both a hope and a lesson for all those striving to oppose large dams.

That we have a lot more to learn from our experience of large dams is clear from the latest order (February 1999) from the highest court in India on the issue of raising the height of the Sardar Sarovar dam. The judiciary, as senior Supreme Court lawyer Rajiv Dhawan argued, has given precedence to projects over people, precedence to pouring concrete over justice to the displaced, and precedence to benefiting the contractors over sending signals that the judiciary will stand by fundamental rights of the people of today and tomorrow. Generations to come will find it difficult to believe that in the closing days of the second millennium, India still built large dams which flooded huge tracks of land and forest, destroyed ancient sites and rivers, shifted communities into homelessness and traded people off like unwanted animals.

Anybody who is interested in the well-being of his or her water systems and societies must read this book. Each page of the book is filled with not just facts and figures, but pearls of wisdom, with the power to illuminate and enrich over present and future. The book would have benefited with use of maps and illustrations. Also, Orient Longman could have done better had they brought out a cheaper paperback edition.

Himanshu Thakkar

FLOODS AND FLOOD CONTROL POLICY: An Analysis with Reference to the Mahanadi Delta in Orissa by Sadhana Satpathy. Centre for Development Studies, Trivandrum, 1993.

THIS book raises basic questions associated with dams which Jawaharlal Nehru had once described as the 'temples of modern India'. The author interrogates the very idea of big dams and the issue of flood control against a canvas which raises a basic philosophical question – whether they are aimed at controlling floods or generating electricity and providing water for irrigation. As she asserts, both the frequency and the intensity of floods on a world scale has increased by one and a half times and between two to three times respectively between the 1960s and the 1970s. This is particularly startling since these coexist with major flood control interventions. She illustrates her concerns with reference to the Mahanadi dam in Orissa.

The author begins by providing an analytical framework and weaving in the available data to argue that there has been no 'declining trend in the extent of the flood damage in the post dam (viz. post 1958) period.' Moreover, as she puts it, the extent of damage suffered by the cropped area due to floods has increased, though the frequency of very large floods has come down in this period.

This takes the author onto the next premise: why is the reduced frequency and intensity of floods in the post-dam period not matched by a corresponding decline in the extent of damage per year. Here she makes certain important formulations. She points to the conflict between the aims of the Hirakud project – power generation, irrigation and flood control. Thus, the idea of keeping the reservoir full by end-August to ensure the generation of power during the dry season is connected to the danger that can be triggered off in case of higher than anticipated inflows in September. This situation, as the author asserts, has been aggravated due to the loss in the storage capacity of the Hirakud reservoir – a phenomenon which she connects to the problem of deforestation, especially in the catchment area in the post-dam period.

Added to this is the extension of the same problem in the downstream areas as well. The author also refers to the longer duration of the floods, which make matters worse by prolonging the pressure on the embankments. Moreover, controlling moderate and large floods have led to an increased settlement in areas which used to be earlier flooded and an expansion of the embankment system which, given the lack of proper maintenance, has in fact caused greater damage. At the same time, she is sceptical about the proposal of another dam at Tikarapada. As she opines, unless deforestation and soil erosion is checked, the problem of siltation would remain.

However, one can have some reservation with regard to the way the author situates the conflicts associated with the aims of the dam. For instance, agriculture in the post-dam period has rarely led to conflicts about irrigation. In fact, one can perhaps venture to hypothesize that the exercise was more aimed at generating power for the regional bourgeoisie and the limited industrial base in the post-dam period. The other point of criticism is of a general nature. The author should have delved into the arena of social history to provide a more holistic picture.

Biswamoy Pati

TAMING THE WATERS: The Political Economy of Large Dams in India by Satyajit Singh. Oxford University Press, Delhi, 1997.

Satyajit Singh's book on the political economy of large dams in India is a welcome addition to the literature on post-colonial development, not only for the importance of its central theme, but also for how it attempts to grapple with it. The central contention of the book is that large dams are accompanied by severe, largely insurmountable, environmental, social and economic shortcomings. But more than that, this book attempts to go beyond standard environmental literature by attempting to demonstrate the political, social and economic processes that led to the adoption of this technology in general.

In the process the book argues that specific paths of technological development are not mere responses to objective necessities, nor inevitable products of the 'march of human knowledge', but that they are driven by definite social and political processes, in particular class processes. The book also makes a strong plea for alternatives which are ecologically less harmful and which could be more equitable in distribution of their benefits, and for a development pattern which combines equity with sustainability. Satyajit Singh's attempt is self-consciously informed by what he calls a 'materialist ecology', drawing on both radical political economy and political ecology.

The book is at its best when confronting the issues connected with large dams. This occupies chapters four, five and six, which contain discussions of economic evaluation, ecological impact and displacement/resettlement respectively. Unfortunately, there is little data beyond 1979. It is interesting to note that large scale construction of large dams only took off after 1964. The late '60s do appear to mark some sort of a structural watershed in the political economy of independent India. The mushrooming of dams was assisted by the adoption of social cost accounting criteria in project evaluation in 1964 which was in reality significantly less stringent than the financial productivity criteria it replaced. As a result, by 1979, 1554 large dams had been built in India, 40% of which were in Maharashtra, no doubt a consequence of the powerful sugar lobby in the state.

This book provides an extensive discussion on the questions of extant evaluation of dams, as well as on overall economic, social and ecological assessments. Satyajit Singh does not reject large dams out of hand, but argues fairly convincingly that if a proper benefit-cost exercise was carried out, taking into account ecological and other costs, including energy costs, and benefits estimated rationally, most dam projects would never leave the drawing board. The proper estimation of benefits is crucial since official figures often overstate them. It is not surprising to learn that official ex post facto assessments are never made, and that later cost escalations are never included in benefit-cost ratios worked out for projects.

Satyajit Singh presents a critique of the arguments claiming that large dams are more cost effective and details their ecological impact. His data is reveals that small projects are less expensive than large ones. He argues that socially, large dams as well as tubewells have tended to economically strengthen rich peasants and landlords, while further marginalising the poor. While the discussion is informed and interesting, it could have done with greater substantiation. Equally valuable is the data on displacement and resettlement. The extent of displacement is shocking – 1554 large dams by 1979 had displaced over 50 million people, if we use an average of 36000 people displaced per dam as obtained from an IIPA study. The author brings together information from a large number of studies and reports to provide a good critique of official resettlement policies.

The other aspect of the book is the elucidation of the social and political processes behind irrigation policy. In the chapters on 'Irrigation, History and Ecological Change in India' and 'State, Classes and Irrigation Development in India' (Chapter 2 and 3), the author analyses different approaches to irrigation and traces the emergence of what he calls the 'civil engineering mindset' in irrigation to the revenue and legitimisation needs of colonial rule, and its persistence after 1947 in the path of planned capitalist development undertaken by the Indian state. Thus, the colonial interventions in irrigation which strengthened the hold of landlords and other elites over these common property resources and marginalised the people was further buttressed by the Indian state. However, these two chapters do not entirely live up to their promise.

First, they attempt to address just too many issues – from irrigation and the state in ancient India, a discussion of Wittfogel's thesis on Oriental Despotism, all the way to nature of the post-colonial state and political economy of planning. As a result the analysis is cursory and often unsubstantiated. Even when in agreement, one often feels like asking: 'But where is the evidence?' With so many major (and contested) issues touched upon, the task of the reviewer becomes that much more difficult!

Second, in some cases what is presented to the reader is an eclectic mixture culled together from different aspects of other scholars' arguments – to take just one example, class analysis from Bardhan, state instrumentality and the planning process from Byres, state-society interaction from Kohli and such like. Presented with a bewildering array of opinions, one is unsure of what his own position is. Some of the book's arguments are not convincing. For example, it is difficult to accept the assertion that, 'We do find the emergence of the autonomy of the state in the absence of any dominant class and the instrumentality of the state in developmental planning and its effect on different class.' How the absence of a dominant class in India is established is never explained. So too some of the book's arguments about ancient India.

The book strikes a rather uneasy balance between the traditionalist view, that traditional agricultural technologies are sufficient even today, and the developmentalist one, that traditional technologies are by themselves insufficient to provide a decent standard of living to people. The former is today fairly popular among environmentalists. The outcome is a lack of clarity, if not self-contradiction. For example, in the analysis of agricultural systems in terms of productivity, stability, sustainability and equity, Satyajit Singh concludes, following Conway, that traditional cropping clearly comes out the winner. He then presents studies which claim that traditional agriculture is more energy efficient than modern agriculture and concludes that: 'The solution to the ecological and social ills of Third World agriculture is thus provided by a seemingly backward, languishing and inefficient peasant production system.' Later, he suddenly asserts that judicious use of modern technology with attention to ecological factors can solve the problems of both efficiency and sustainability. While sharing his hopes, one wishes that they were based on more solid foundations. Another tricky question for environmentalists relates to population growth and here too the book is unfortunately unable to demarcate itself sufficiently from the reigning neo-Malthusian philosophy.

The book makes a strong claim for establishment of hydraulic rights for the people. The author supports collective control over hydraulic property, but rather naively remarks that this 'may not be difficult given the huge amount of public expenditure in irrigation.' How collective control could be established in our unequal exploitative society 'easily' has, no surprise, not been spelt out.

The last chapter provides a discussion on green movements and alternatives. Pointing towards the multi-class nature of the green movements in India and their diverse ideological stances, the book notes that insufficient attention has been paid to ideological matters by the various environmental groups. It correctly points out, as against some left critiques, that analysing these movements in terms of the categories of their

theoreticians does little justice to the peoples' struggles against impoverishment and marginalisation. The last sections are an interesting discussion on alternative irrigation strategies – water harvesting, traditional canal systems, tanks and so on, as well as small hydropower projects. The cost effectiveness of these technologies as well as their potential is explored in some detail.

The book concludes by stating that these alternatives have not been tried out because of vested interests and the development pattern adopted by the state. The very fact that small movements and resource-poor environmental organisations have built a few successful examples speaks volumes for their feasibility. It also demonstrates that traditional irrigation systems may not be a panacea for all our needs; that we may still need large dams. And in any case we cannot dismantle the ones already there. But our additional water needs can be met through a judicious combination of these small scale community based technologies. These technologies can only succeed when appropriate institutional structures are created, as in China, which empower local communities to manage and build them. Thus, what is required is not just a change of focus on the part of the state, but a more radical change in property relations and social institutions in general.

The book could have done with greater editorial assistance; some sections carry too strong a flavour of the dissertation. In its attempt to comment on everything, it is often unable to do justice to important topics. It also attempts to balance too many differing views. Consequently, the debate between these different approaches never emerges clearly. The book suffers from the same problem which it finds in the environmental movement – a lack of clarity on ideological issues. The debates and differences between neo-classical environmental economics, radical political ecology, various shades of Marxist political economy and the post-modernist environmentalism is never spelt out, though one can find bits and pieces from all these approaches in the text. Finally, the implications of the analysis for the politics of the environmental movement could have been dealt with in more detail. These caveats apart, this is an interesting book tackling important issues. One hopes that it will succeed in provoking a debate among organisations and individuals interested in building a more equitable and ecologically sustainable society.

Ashok Prasad

THE COLONIAL FOREST POLICY IN UTTARAKHAND (1890-1928) by Amar Farooqui. Kitab Publishing, New Delhi, 1997.

Amar Farooqui's book presents a critique of the British forest policy in the Kumaun – a chronological account of the forest policy and its consequences on the people of Kumaun between the late 19th and early 20th century. In the preface Farooqui states that the present problem of Uttarakhand is one of backwardness. According to him, 'The roots of the Uttarakhand problem, its backwardness, lie in the nature of colonial intervention in the area. It was colonial rule that introduced distortions in the Uttarakhand economy.'

The book seeks to examine the 'backwardness' of the colonial forest policy in a historical perspective. Farooqui's argument is straightforward: the colonial state's interest in the forests of Kumaun was driven by a profit motive. He is careful in not glorifying the pre-colonial economy or culture as the thrust is on the distortions brought about by colonial rule. He further argues that the system of classification and preservation of forests which was developed in the last quarter of the 19th century helped mask the economic imperatives in the language of law and environment. Farooqui examines the forest policy of the colonial state in the context of the existing forest acts (of 1865 and 1878) and the contemporary research by A.J. Voelcker in the 1890s. He maintains that Voelcker's work was responsible for shaping the forest policy of the British Empire.

The book provides a mass of information regarding the changes in the forest policy in the last decades of the 19th century. The first chapter gives an account of the British conquest of the hills in the first quarter of the 19th century; it also provides a geographical account of the area. The next chapter, mainly conceptual, deals with the colonial forest policy as a whole. The real examination of the effects of the policy begins in the third chapter which is divided into six parts. Beginning with the various aspects of the pre-colonial economy, the chapter moves on to discuss the advent of the British in the early years and the subsequent colonization of the people. The fact that the colonial state could not increase its revenue because of low agricultural productivity shaped the annexationist nature of the forest policy. The final sections of the chapter show how the people were restricted from exercising their traditional rights over the forests and its produce, were forced to abandon the hills in the summer to make way for British hill resorts, and compelled

to change their diet in order to escape starvation. It also shows how the growing authority and authoritarian nature of the forest department led to conflicts within the colonial administration. The outbreak of the War was a timely coincidence as it put an end to the growing controversy between the district administration and the forest department.

The next chapter provides an account of people's resistance to the practice of forced labour, also known as 'coolie begar'. The forest agitation of the early '20s is closely linked to the anti-begar struggle in the area. Insufficiency of data makes it difficult to establish links between the forest agitation – which included strikes and burning of forests – and the larger non-cooperation movement. However, 'the forest agitation and the anti-begar struggle gave an impetus to the anti-colonial struggle in Kumaun rather than the other way round.' The struggles forced the British to abolish the hated coolie begar in 1921, somewhat curbing the authoritarian nature of the forest department. By 1928, the year the Royal Commission on Agriculture presented its report, the old aggressive stance of the colonial forest policy was over.

Farooqui's exhaustive account of the economic imperatives of the colonial forest policy draws on a mass of facts and figures. However, his theoretical framework smacks more of assertion and less of analysis. The book tries to make a connection between bourgeois conception of property and the colonial forest policy. But the terms of reference are not made clear as bourgeois conception of forest (derived from property) is quite easily connected with colonial rule, which in turn is described as 'Oriental Despotism'. This lack of rigour permits easy formulations, which are not substantiated through either facts or figures. The conclusion, in particular, is replete with random and unexamined statements. The chronological framework is abandoned as the argument rapidly shifts between the customary rights of the hill people in Kumaun and those of the tribals in post-independence India. Farooqui attempts to distinguish between 'bourgeois conception of forests' (the *raison d'être* of the colonial forest policy) and the 'bourgeois right in forest'. According to him, bourgeois rights in forest did not congeal in Kumaun because absolute rights of the state became a substitute for the assertion of bourgeois rights.

Surely, the question that needs to be answered is how bourgeois was the colonial state? Farooqui agrees that 'hegemony and plunder makes it difficult for capitalist development in a colony to be along the same lines as in a metropolis' and also states that the colonial state reinforced certain pre-capitalist forms of surplus extraction (such as coolie begar). However, the question as to why we should consider the colonial forest policy as 'bourgeois' remains unanswered. That colonial rule was aimed at hegemony, loot and plunder is hardly a new thesis. What is new and interesting are the ways in which people struggled against it. Farooqui's book attempts to recount this in the context of the forest policy in Kumaun. Unfortunately, because of a lack of clarity about terms and categories, the book is unable to give a clear picture of the resistance by the people against the British. We do realise that official information is often more readily available than the accounts of people's struggles. However, since Farooqui emphasizes the need to retain the radical content in people's struggles, it is but fair to expect a richer account. Stylistically the book suffers because of rhetoric. Passionate language gets the better of analysis.

Sharmila Purkayastha

TEAK AND ARECANUT: Colonial State, Forest and People in the Western Ghats (South India), 1800-1947 by Marlene Buchy. Institut Francais de Pondichery/IGNCA, 1996.

THERE has of late been a proliferation of works focusing on aspects of the history of forests. The colonial state's interest in forests accounts for the vast and detailed archive on forest history. This practical aspect, along with a recent interest in issues concerning the history of the management of natural resources, perhaps, explains the historiographical tendency. The present book is a well-intentioned addition to the corpus.

In chronicling the phased elaboration of forest administration, Buchy situates her study within the prevailing debate on whether 'colonialism marked an ecological watershed.'[1] Her study, spanning a hundred years of forestry, concludes that it is difficult to draw an ecological balance sheet of the colonial period. The improvements in forest cover in one area (teak) were offset by deterioration in other areas (evergreen forests). Her comment on the post-colonial situation is offered as a vindication of the positive slant of her balance sheet. In the post-1947 period, the scale of forest

1. Madhav Gadgil and Ramachandra Guha, *This Fissured Land: An Ecological History of India*, OUP, Delhi, p. 116 and Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism*, OUP, Delhi, 1995, pp. 380-1.

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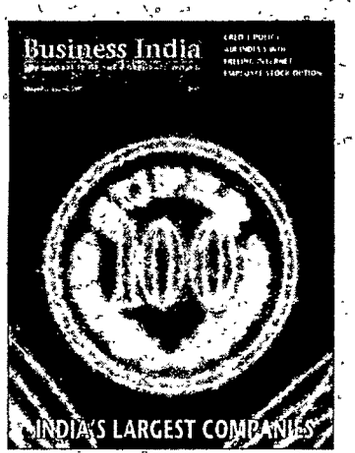

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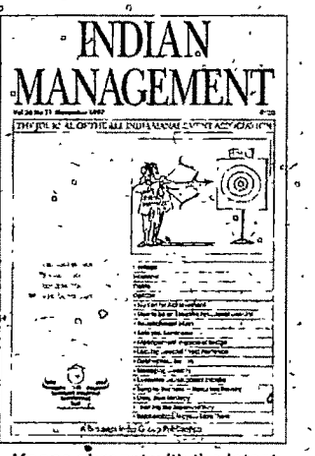

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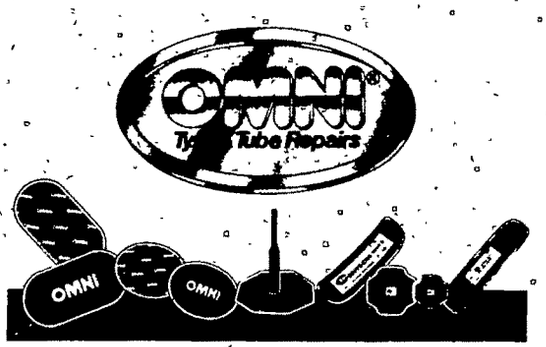

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exploitation increased and the new regime found little that was offensive or worthy of change. The local populace discerns no difference as between the colonial and post-colonial periods (p. 228). Neither system was rooted in the locality and consequently faced opposition by the affected sections of the populace. This conclusion perhaps reflects the problems intrinsic to the terms and focus of the original debate. The inauguration of bureaucratic management of forests is undeniable. What is less demonstrable and more contentious is that colonial management *per se* inaugurated an era of ecological crisis.

Related to this, Buchy asserts that the state-of-play at the ground level does not permit the construction of a binary between the colonial state and the populace. This perspective does not account for the existence of the local elite which participates in and benefits from the changes brought in by the forest department. The indictment of what is for convenience referred to as 'colonial forest management' is, in the author's view, often without basis. This argument is given substance by the analysis of pre-colonial forest-based societies which very obviously were not the blameless communities that they are made out to be in some recent historiography. In the author's opinion, it is not as though pre-colonial communities were inherently predisposed to nature conservation, or that they used natural resources only in a communal manner. At one level this argument is refreshing given the prevailing orthodoxy which seeks to sharply delineate colonialism as a watershed, in the process extolling the past, which itself, on closer scrutiny displays many shortcomings. (In the Indian case, unequal access to natural resources of the *mlecchas* or outcastes, is only one instance.)

At another level, however, this argument presents many difficulties. The most obvious is that if colonialism did not mark a watershed, why is it that the author persists with using 'colonial' as an adjectival prefix to forest management? Later, though the author ventures to question the category 'colonial forestry', the term continues to be used. In the Indian case, what does colonial mean and how is one to identify it? The author's inability to recognise the historical specificities of the varieties and evolution of particular stages of domination lead her to draw cross historical comparisons between the colonialism during the age of expansion in 14th and 15th centuries and the colonialism of the mid-18th century.

The integration of India into the expanding British empire from the middle of the 18th century entailed a more complex process than the relatively crude commercial exploitation of the colonies in the New World during the waves of expansion from south Europe in the 14th and 15th centuries. Tangible and clear-cut indications of colonialism are not always to be found everywhere in the Indian case, but in most instances it is only in the overall nature of transformation of the macro-economy and in the attendant administrative, social and cultural changes, that the term 'colonial' has any real meaning. This is the reason why a very locality-specific study of one aspect (forests) can lead to conclusions which are not sustainable if a wider geographical span and an inter-sectoral view of the socio-economic transformations are taken. In these transformations, some groups gained. That is the essence of domination, recognised even in currently unfashionable historical accounts. The term 'compradore', after all, is not of recent vintage.

The book is divided into two parts. The first deals with every imaginable aspect of forest management: legislation, settlement, administration, the working plans, the market and labour. The author's familiarity with the more technical aspects of scientific forestry is evident. The portrait is pieced together from a variety of sources, and no detail is thought too unimportant to be missed. The details are the strength of the book despite the impression that the author has not been fully critical about the sources from which the information is pieced together.

The second part of the book is equally informative and based on a wide reading of primary material. This section focuses on the impact of forest policy on those dependent on the forests. Arecanut, coconut gardens, rearing livestock, sedentary agriculture and *kumri* (shifting cultivation) practices are described, as is the impact of forest policy on them. In the description of the social responses to the policy, the reviewer wishes that the author had stuck to the straight-forward presentation of a narrative culled from the wealth of historical sources which form the core of the book. The author's tendency to constantly refer to secondary literature seems superfluous given that the reading of the records by themselves would have led the author to certain direct and more rigorous conclusions about the nature of protests.

A historian needs to be clear about the circumstances under which authority is either petitioned or confronted directly. That those at the bottom of the rung have no recourse to any strategy other than that which is called 'everyday forms of protest' has implications on the nature of control exercised and on the outcomes

of these modes of survival (which are glorified as acts of 'resistance'). The only outcome is that it irks the management, a fact amply recorded in official records. It does not lead to a substantial improvement in the conditions of existence of the footdraggers, nor does it lead to a transformation of the power structure. The author's own sources would have sufficed in constructing a typology of protest, where the nature of dependence on forests would correspond in some measure to the nature of resistance. The arecanut owners were more militant. They were placed in a more advantageous position vis-à-vis the kumri cultivators who were more subdued in their response to forest management.

This criticism is intended to focus attention on the overall merit of the book which makes evidence from a wide record base available to readers. For a historian with such a rich primary source base, citing the latest and the most fashionable in a token and piecemeal manner is superfluous.

Bela Malik

BANDINI MAHANANDA by Dinesh Kumar Mishra. Samata Prakashan, Patna, 1994.

'Just wait and see what happens once the river valley projects are completed; India will become a lush green haven. Have patience. We are on the threshold of a new age, an age of light and electricity. We will arrest the waters of these rivers and build such mammoth dams on them that the world will be simply awestruck. We shall produce electricity from the waters and illuminate our villages. No more deaths of darkness for them; we will electrify them with the light of life.'

Amrit Rai, *Sargam*,
Hans Prakashan, Allahabad, 1977.

Nehruvian rhetoric at the nation's 'moment of arrival'? The internal evidence of the above quote suggest its year as 1954: the same year when Nehru experienced a glorious high walking on the unparalleled heights of the Bhakra Nangal dam. And the author of the text, a story, appropriately – and ironically – called *Sapnay Aur Sapnay* attributes the voice to *Akashvani*, which was the authentic one way channel of communication between the dream-merchants and those who wished to buy those dreams. (Was there a dearth of such people?)

As if the charms of the voice were not enough, a more magical set of fantasy churners picked it up and gave it a plausibly narrativised audio-visual *avatar*: the Mumbai cinema in one film after another immortalised the image of the city-bred engineer-hero sacrificing modern comforts to provide succour to the flood and famine stricken village folk. As heroes never fail, so the cinematic version of our very own 'going to the people' movement was a resounding success. And the village lived happily ever after. The government engineer had after all given them the panacea: the dam!

However, even in the heady fifties, there were a handful of sceptics who refused to be enchanted by the sing-song chorus of progress, simply because the rhetoric did not gel with their harsh realities. Debu, the hero of Amrit Rai's story referred to earlier, is one such unemployed cynic who receives the hope-filled speech with a bitter sense of irony.

It is more than just irony that pervades the pages of Dinesh Kumar Mishra's powerful book under review. It evokes a deep sense of pathos, anger and 'disillusionment of hope'. Mishra, himself an engineer, is unsparing in his criticism of the myopic triumvirate of leaders, engineers and contractors in independent India who saw the rivers as mere water resources and floods as an epidemic, a challenge to their swollen rationalist egos. They did not deign to learn anything from tradition – mythological, popular or historical. Our angels ran amuck where even colonial devils had feared to tread.

Consider the result: in 1954 – before the war against waters – Bihar had 25 lakh hectare land in the shadow of floods. After spending Rs 614.11 crore and decades of discussion, planning, lethargy and implementation, the potential flood vulnerable zones have spread to 65 lakh hectare. The book is full of such marvels, statistics culled from government sources. Another such report tells us that Bihar is the most seriously flood affected state: 37% of its territory and 56.5% of the total national population exposed to floods is in Bihar. In north Bihar, 76% of the area is witness to regular floods, big and small.

North Bihar does not have big dams. What it has is a number of embankments along with its vast rail and road networks which virtually function as *bunds*. The result is waterlogging and more ferocious floods. So what the people under the supposed *Goverdhan* of embankments did gain is misery and dependence on a 'money order' economy in place of the self-sufficiency that they earlier enjoyed. To quote Kant Lal (35 years old, of Sikatia village, Katihar): 'I am no more a man. Wandering here, I have become a camel as my land is now a piece of desert. I shall be condemned to grow *kakri* and melon where my grandfather once grew rice and my father wheat. We had people coming from Mungher, Arrah, Ballia and Chhapra to work our farms. Now we have to go to Punjab to eke out a living. This embankment is no water trap, its our deathtrap' (p. 89).

This acute human suffering, the downstream slide from a position of relative prosperity to one of unbearable uncertainties of dispossessed refugees has been achieved rather swiftly, in the span of a mere 30 years.

Of course, there was a time when rivers were identified with civilizations, when they a were seen as life-givers, their 'banks' literally meant *teerth*, a seat of deities and a site for festivities. Floods happened even then but did not cause undue consternation. Like Rambriksha Benipuri's *Son of the Flood*, Bisesar, human beings saw in them gods, not ghosts, as the floods also brought with them fertility and fish. They also brought devastation, but that was to be taken with humility, in one's stride, as did Phanishwarnath Renu's peasants in *Parti Pari Katha*. Thus, the terror and blessings of the river-goddess complemented each other to create a harmony, a cultural and economic repertoire for solace and survival.

Somewhere along the line we lost this innocence. We borrowed the arrogance of technological triumphalism from the West. As modern, one-dimensional entities, we started to love gardens and fountains and hate the wilderness and floods. Like the monster in a north Bihar folklore who strove and failed to dam and win the beautiful Kosi for himself, we wished to tame what was untameable. The Kosi continued to flow and meander across embankments. And now the Mahananda, which had no such infamous history, too has become defiant in response to our domesticating adventures.

Mishra's book is an absorbing account of misplaced priorities, incorrigible obstinacy, corrupt practices and rushed misadventures undertaken by the creators and the profiteers of what had become, and continues to be, a veritable dam industry. Carefully crafted, the wealth of the book speaks through its self-explanatory chapters: *(i)* Bihar, Floods and the Mahananda, *(ii)* Technologies of Flood Control, *(iii)* Before the Taming of the River, *(iv)* Mahananda in Captivity, *(v)*...And the Deluge After, and *(vi)* Quo Vadis?

The book is written in lucid Hindustani, with a good measure of Sanskrit *shlokas* and Urdu *sh'ers* thrown in; it also has stylistic novelty – something that seems to have become a feature of Hindi productions on ecology. (I am sure the readers are acquainted with Anupam Mishra's beautiful and innovative books.) Bandini Mahananda carries breathtaking photographs, clear maps, artistic sketches and innovative data helpfully explained through graphs – all brilliantly captioned. However, all of these – the whole book, in fact, except the cover – is in black and white. This lack of finesse and glitz in production is an index of its distance from Delhi, the Gangotri of resources. I earnestly hope a future edition will find better-heeled publishers and also remove the glaring typos.

The book is a compulsory read besides being a passionate appeal for rediscovering the art of living with floods. Though it is not easy, remembering what we have forgotten will perhaps give us the strength to refuse the lure of IMF alms outside and vote-fishing relief gimmickry inside.

Ravikant

FLOODS, FLOOD PLAINS AND ENVIRONMENTAL MYTHS. State of India's Environment: A Citizen's Report, 3 edited by Anil Agarwal and A. Chak. Centre for Science and Environment, New Delhi, 1991.

THE annual flooding that takes place in the Gangetic and Brahmaputra flood plains results in the loss of numerous lives and thousands of crores of rupees. Both these figures have been on the rise over the past few decades, suggesting a steadily worsening situation. The report under review explores a number of common misconceptions about the causes of, and potential means of reducing, the annual threat to life and property in the plains.

Although the report is now almost ten years old, it has lost none of its relevance. For the vast majority of Indians who hold an opinion on the subject and to most international environmental commentators, flooding in the Gangetic and Brahmaputra valleys is primarily a consequence of the misuse of land resources – through overgrazing, deforestation and cultivation – within the Indian and Nepalese Himalaya which form the catchments of these rivers. Solutions for the problem tend to be couched in terms of the need to afforest Himalayan hillsides, necessarily involving a reduction in the human and cattle population in the region. For the majority of officials directly involved in flood control in the region, the solution to the problem lies in an attempt to control these rivers – primarily through the building of dams in the higher reaches of the rivers and embankments to control the rivers once they enter the valley plains that they annually flood.

The report questions the validity of both positions. In the first instance the report argues that the high incidence of flooding in the plains, and the associated high levels of soil erosion, are more a function of

rainfall, geology and tectonic processes than anthropogenic pressures in the form of grazing, cultivation and deforestation. While the latter may contribute marginally to the levels of soil erosion and to a decreased capacity of the watersheds to store water, flooding is ultimately a function of high intensity and prolonged rainfall events. The high levels of soil erosion (important in this context because of the physical damage that accompanies the movement of boulders, but also to the increased propensity of rivers to overflow their banks owing to the deposition of soil and consequent elevation of river beds) in the Himalaya is largely related to the fact that these mountains are naturally highly erosive, a consequence of the fact that they are still active, rising by several centimetres every year.

Landslides are a natural correlate of such tectonic activity, and, according to this report, are the primary source of the huge volumes of soil carried from the Himalaya to the plains. The report stresses the fact that while greater levels of forest cover in the Himalaya are desirable, this is largely due to the need to meet local fuelwood and fodder requirements. Afforesting the Himalaya is unlikely to reduce the flooding that the 400 million inhabitants of the plains are annually subject to.

In three detailed chapters, the report explores the abject failure of flood control authorities to reduce the extent of damage suffered annually by the residents of the plains. The increase in damage has shot up over the past five decades, and the report holds flood control measures as primarily responsible for this situation. For the most part flood control has been attempted by building embankments aimed at keeping flood waters within the boundaries of the embankments built on either side of the major rivers. Thousands of kilometres of river length have been embanked in this fashion over the decades. The report argues, echoing findings in other parts of the world, that the embankments marginally serve to control the flood waters, but once the embankments are breached, a routine occurrence, the impact of the flood is far greater, since the released water is concentrated in its intensity as it finds release from the enclosing embankments.

In addition, the embankments often prevent the flood waters from receding, resulting in standing water and excessive waterlogging. Disease, affecting both cattle and humans, and lowered crop fertility is a direct result. The presence of the embankments has also interfered with earlier patterns of silt deposition over cultivated lands, a key factor in sustaining the productivity of the region. Simultaneously, the presence of embankments provides a false sense of security to government agencies and villagers alike, resulting in an increased attempt to settle human populations, often the landless, on lands that are now expected to be free of flooding.

The report highlights the political dimensions of flooding and flood control programmes. Inevitably, the poorest live in closest proximity to the rivers and have, therefore, to bear the brunt of the floods. In addition, given the heavy expenses involved in the building of embankments, a politician-bureaucrat-contractor nexus ensures that funding for embankments continues. Much of this is siphoned away simply owing to the fact that the annual floods destroy any chance of evaluating the extent to which funds were used in the building or maintenance of embankments. In the vicious cycle that ensues, existing breaches or weak spots in the embankments continue to allow the river's contained fury to explode on the population just beyond the embankments. Even were the embankments to be effective in containing a flood, the fact that these rivers routinely change course, the Kosi river having moved 120 kms westwards over the past 250 years, points to the necessarily short-term nature of such flood control measures.

The report argues that any solution to the problem will have to take greater cognisance of local ecologies, and ultimately will have to be based on a greater willingness to live with and adapt to floods rather than a continuation of the attempt to control the flow of rivers. If the Himalayan soil left behind by the flooding Ganga and its tributaries was responsible for the high productivity of northern Bihar four decades ago, the extreme impoverishment of the region today is largely due to the embankment process that has denied the local population the benefits of this annual enrichment. The same enriching process needs to be tapped again, if local communities are to benefit from and not solely lose out on account of the flooding.

Apart from highlighting the problems with current flood management in India, the report provides a wealth of statistical information on all sorts of issues related to floods – the incidence of flooding over the years, damage assessments, government compensation, extent of area inundated every year in different parts of the Gangetic and Brahmaputra valleys, productivity figures, and so on. Although occasionally repetitive, the report is well written and authoritatively backed by data from the secondary literature. A must read for anyone interested in the issues.

Vasant K. Saberwal

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Backpage

WITH the somewhat unexpected revolt of senior Congressmen Sharad Pawar, P.A. Sangma and Tariq Anwar, the 'issue' of Sonia Gandhi's 'Italian' origins as the decisive marker of her suitability as a prime ministerial candidate has come to occupy political centre-stage. In doing so, they have added weight to the ongoing BJP campaign of Rome Raj vs. Ram Raj, the dialectic of *swadeshi* vs. *videshi*.

Whatever be the political compulsions impelling the 'dissident' Congressmen in raising the issue at this time, there is little denying that it will further vitiate the political atmosphere. Notwithstanding Prime Minister Vajpayee's 'statesman-like' remarks that Sonia Gandhi's origins should not become a matter of unseemly political rhetoric, those in the fray as also noted columnists have raised the issue to a feverish pitch. What with drawing room chatter about the spectre of foreign rule, the need to remember the 'spirit of 1857' and the reported threat of self-immolation by Uma Bharati in the event of the 'decisive blow to national pride', we are in for a hot summer.

Is all this orchestrated raising of temperatures only due to an assessment that the Congress under Sonia Gandhi has once again become a serious contender for power? When the lady from 10 Janpath first assumed charge of the Congress, there were sniggers galore. She was, after all, untried and untested, preferring to manoeuvre from the shadows rather than face the masses. Equally, there was widespread dismay that the once glorious party seemed to have been reduced to a single asset – the Family as icon.

Today even her worst detractors grudgingly admit that the lady's interventions and game plans have given fresh hope to a party that analysts, only a couple of years back, had described as being in a state of terminal decay. Be it stemming the outflow of leaders, giving greater weightage to younger and more dynamic elements, leading the Congress to victory in three state assemblies and, at least till sometime back, advocating a politics of restraint – Sonia Gandhi's contributions cannot be easily dismissed. Is this why the issue of her Italian origins has resurfaced?

At one level, the question has already been settled by our Constitution. Notwithstanding debate in the Constituent Assembly about the U.S. laws governing those seeking political office, the members chose to place no such bar on naturalized citizens. And Sonia Gandhi has been an Indian citizen since 1983. One can and should be critical of her relative political inexperience, that she has so far not faced the electorate in the hustings, or even that her views and thinking on many issues remain an enigma. But to harp on her origins is symptomatic of a dark, xenophobic streak in our national consciousness which deserves to be decisively countered.

Not too far back many in our country expressed grave reservations about leaders/rulers with whom they did not share ethnicity. Yet there is no dearth of examples when native principalities 'imported' not just courtiers, generals and priests, but rulers. In the event they acquired legitimacy by becoming one of the people and acting in their interests, they were not just accepted but lauded. The role of the Britishers from Annie Besant to Sister Nivedita, C.F. Andrews to Madeleine Slade (Mira Behn) during the national movement continues to be remembered with fondness and pride.

The fear is that if this discourse continues unchecked we may soon start questioning the legitimacy of (and indeed we have done so in the past) all those with whom we do not share some attribute – place of birth, religion, caste, language, colour of skin. What then happens to our notions of inclusive nationalism, of claiming India as *vasudhaiv kutumbukum*? Our operative principles can only be the regime of rules and laws enshrined in our Constitution which we have democratically chosen to live under and governed by. Nothing else.

We never questioned an MGR on his Sri Lankan/Malyali origins. There are no objections when candidates to the Lok Sabha shift constituencies, often to radically different regions. We have even absorbed and elected as leaders those who took up arms against the Indian state. Remember Laldenga? For an elite ever keen to acquire the benefits of a dual citizenship and thereby deal with multiple and conflicting loyalties in an increasingly globalised world, this relapse to narrow primordialities can only be described as sad.

We should be glad that Sonia Gandhi has decided to come out of the shadows and seek legitimacy in the court of the people. We should judge and choose on the basis of her ability to lead rather than place of birth or membership by marriage to a family. In doing so we elevate ourselves.

Harsh Sethi